



CITY OF  
**SARATOGA SPRINGS**

# **DRINKING WATER BOOSTER #8 VOLUME 1 - SPECIFICATIONS**

## **BIDDING DOCUMENTS**



**FEBRUARY 2023**



# **SARATOGA SPRINGS**

## **DRINKING WATER BOOSTER #8 VOLUME 1 - SPECIFICATIONS**

**February - 2023**

### **BIDDING DOCUMENTS**

**Project Engineer**

**HANSEN, ALLEN, & LUCE, INC.  
Consultants/Engineers  
859 West South Jordan Parkway – Ste 200  
South Jordan, Utah 84095  
(801) 566-5599**

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# **PART 1**

## **BIDDING REQUIREMENTS**

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**SECTION 00 11 13**  
**ADVERTISEMENT FOR BIDS**

**NOTICE**

Notice is hereby given that the CITY OF SARATOGA SPRINGS (OWNER), will accept bids for the construction of the DRINKING WATER BOOSTER #8 Project (Project) according to Contract Drawings and Specifications prepared by HANSEN, ALLEN & LUCE, INC. (ENGINEER), and described in general as:

*The construction of a drinking water booster pumping station, with five (5) pump cans and process lines (ultimate 9200 gpm flow), with three (3) of the process lines functionally complete with pumps, 100 hp motors, and valves (for 4700 gpm this contract capacity). A future contract will complete other 2 process lines and add 2 pumps and 250 HP motors. Work includes providing an extension of RMP power to site and removing +/-14 feet of collapsible clays below pump station and refilling with structural backfill; steel and DIP piping, 2 bladder type surge tanks; valves (automated and manual), flow meters, fittings and appurtenances; masonry block building with standing seam metal roofing; HVAC system; site work, grading, drainage facilities, asphalt paving, concrete walks, curb and gutter, rock surfacing; 24- and 16-inch inlet/outlet DIP pipelines with air valve vaults and connections to existing pipes; electrical, instrumentation, and control systems, standby emergency generator, wiring, telemetry, Owner-provided RTU, light poles, motorized gate, chain link and ornamental fencing, conduits for future security system, and other work.*

**BIDS DUE**

Separate sealed bids will be received by OWNER until **2:00 p.m. on Tuesday March 21, 2023**. Bids may only be submitted through the SciQuest bidding site/Utah Public Procurement Place (U3P).

<https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=StateOfUtah>

A virtual meeting will be held one hour after the bids are received where the bid results are shared. Bid results will also be posted to the U3P web site.

**VIRTUAL BID OPENING MEETING INFORMATION**

The bid opening meeting for the City of Saratoga Springs DRINKING WATER BOOSTER #8 Project will be held through a video meeting. To obtain an invitation to this meeting send an email to [tjones@halengineers.com](mailto:tjones@halengineers.com). Bidders should attempt to connect at least 10 minutes before the meeting to ensure they can access the meeting. If problems arise you may call 801-566-5599.

Preliminary results will be read aloud. An apparent low bidder will be announced. After the public bid opening, OWNER will review the bids for accuracy to ensure bidders have met all requirements.

**NOTE:** *Please mute your microphone during each meeting, unless you are speaking, as this will help cut out the extra noise during the meeting.*

## **BID DOCUMENTS**

Bid documents may be downloaded from the SciQuest bidding site/Utah Public Procurement Place (U3P) beginning **Wednesday, March 1, 2023**. No paper copies of the Contract Documents will be available.

<https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=StateOfUtah>

Bid security in the amount of 5% of the base bid will be required to accompany bids.

## **PRE-BID CONFERENCE**

Prospective BIDDERS are encouraged to attend a Pre-Bid conference which will be held at the City of Saratoga Springs Public Works office located at 213 North 900 East, Saratoga Springs, Utah 84045 at **11:00 a.m. on Tuesday March 7, 2023**. The object of the conference is to acquaint BIDDERS with the site conditions, specifications, and to answer any questions which BIDDERS may have concerning the project.

The meeting will be in the Public Works conference room.

## **QUESTIONS**

All questions relative to the project shall be submitted through the SciQuest bidding site/Utah Public Procurement Place (U3P).

<https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=StateOfUtah>

OWNER reserves the right to reject any or all bids; or to accept or reject the whole or any part of any bid; or to waive any informality or technicality in any bid in the best interest of OWNER. Only bids giving a firm quotation properly signed will be accepted.

- END OF DOCUMENT -



**SECTION 00 21 13**  
**INSTRUCTIONS TO BIDDERS**

**ARTICLE 1 – DEFINED TERMS**

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office* – The office from which the Bidding Documents are to be issued.

**ARTICLE 2 – COPIES OF BIDDING DOCUMENTS**

- 2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

**ARTICLE 3 – QUALIFICATIONS OF BIDDERS**

- 3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:
- A. Evidence of Bidder's authority to do business in the state where the Project is located.
- B. Bidder's state or other contractor license number, if applicable.
- C. Evidence of successful completion of three similar projects, including project name and contact information for owner of the project.
- 3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.
- 3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

**ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE**

- 4.01 *Site and Other Areas*
- A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

#### 4.02 Existing Site Conditions

##### A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:
  - a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
  - b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
  - c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
  - d. Technical Data contained in such reports and drawings.
2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply
4. Geotechnical Report. The project Geotechnical Report by AGECEC entitled "Geotechnical Investigation, Proposed Pump Station Approximately 700 West, South of Pony Express Parkway, Saratoga Springs, Utah, dated July 11, 2022 - is not part of Contract Documents but is made available to Contractors at their request by emailing Project Engineer (at Hansen Allen, & Luce) Nathaniel Jones at email [tjones@halengineers.com](mailto:tjones@halengineers.com).

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

#### 4.03 Site Visit and Testing by Bidders

- A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.
- B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

- C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.
- D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.
- E. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

#### 4.04 *Owner's Safety Program*

- A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

#### 4.05 *Other Work at the Site*

- A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

### **ARTICLE 5 – BIDDER'S REPRESENTATIONS**

#### 5.01 It is the responsibility of each Bidder before submitting a Bid to:

- A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;
- B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
- C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;
- D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;
- E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and

drawings identified in the Bidding Documents, 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 Bidder; and (3) Bidder's safety precautions and programs;

- F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;
- G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
- H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;
- I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and
- J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

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

- 6.01 A pre-Bid conference will be held at the time and location stated in the invitation or advertisement to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

#### **ARTICLE 7 – INTERPRETATIONS AND ADDENDA**

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

#### **ARTICLE 8 – BID SECURITY**

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.
- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

#### **ARTICLE 9 – CONTRACT TIMES**

- 9.01 The number of days within which, or the dates by which the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

#### **ARTICLE 10 – LIQUIDATED DAMAGES**

- 10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

#### **ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS**

- 11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.
- 11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

#### **ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS**

- 12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.
- 12.02 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

- 12.03 The apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work: concrete and/or civil site work.

If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

- 12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

#### **ARTICLE 13 – PREPARATION OF BID**

- 13.01 The Bid Form is included with the Bidding Documents.

- A. All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
- B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

- 13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.

- 13.03 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

- 13.04 A Bid by an individual shall show the Bidder's name and official address.

- 13.05 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

- 13.06 All names shall be printed in ink below the signatures.

- 13.07 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

- 13.08 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

- 13.09 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

#### **ARTICLE 14 – BASIS OF BID**

##### **14.01 *Unit Price***

- A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
- B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity" (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

##### **14.02 *Allowances***

- A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

#### **ARTICLE 15 – SUBMITTAL OF BID**

- 15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.
- 15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed OWNER at the address in Article 1.01 of the Bid Form.
- 15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened
- 15.04 Bidder must also complete and submit the following documents with their Bids:
- A. Bid Form – Section 00 41 00
  - B. Bid Bond – Section 00 43 13
  - C. Contractor Qualifications and Experience – Section 00 45 13
  - D. List of Subcontractors – Section 00 45 16

## **ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID**

- 16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.
- 16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

## **ARTICLE 17 – OPENING OF BIDS**

- 17.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

## **ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE**

- 18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

## **ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT**

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.
- 19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.
- 19.03 Evaluation of Bids
  - A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
  - B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.
- 19.04 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers



proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

- 19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

#### **ARTICLE 20 – BONDS AND INSURANCE**

- 20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

#### **ARTICLE 21 – SIGNING OF AGREEMENT**

- 21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

- END OF SECTION –

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**SECTION 00 41 43**  
**BID FORM**

Project Identification: **DRINKING WATER BOOSTER #8**

Contract Identification and Number: 360.39.100

**ARTICLE 1 - BID RECIPIENT**

1.01 This Bid Is Submitted To: **CITY OF SARATOGA SPRINGS**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in the Bid and in accordance with the other terms and conditions of the Bidding Documents.

**ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS**

2.01 Bidder accepts all of the terms and conditions of the Advertisement and Instructions to Bidders, including without limitations those dealing with the dispositions of Bid security. The Bid will remain subject to acceptance for 30 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

**ARTICLE 3 - BIDDER'S REPRESENTATIONS**

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____

B. Bidder 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. Bidder is familiar with and is satisfied as to all Federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in SC-5.03, and (2) reports and drawings of Hazard Environmental Conditions, if any, at the Site that have been identified in SC-5.06 as containing reliable "technical data."

E. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations

obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, 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 Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs.

- F. Based on the information and observations referred to in Paragraph 3.01.E above, Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of the Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- J. Bidder will submit written evidence of its authority to do business in the State or other jurisdiction where the Project is located not later than the date of its execution of the Agreement.

#### **ARTICLE 4 - BIDDER'S CERTIFICATION**

4.01 Bidder further represents that:

- A. This Bid is genuine and not made in the interest of or on the behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
  - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
  - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

#### **ARTICLE 5 - BASIS OF BID**

5.01 Bidder will complete the Work in accordance with the Contract Documents for the prices identified in the bid schedule on the following page.

- B. The completion dates shall be fixed with no additional days or extensions provided for work stoppage including weather delays.
- C. Unit Prices have been computed in accordance with paragraph 11.03.B of the General Conditions.
- D. Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the contract Documents.

**DRINKING WATER BOOSTER #8 – BID SCHEDULE**

Item No.	Description	Unit	Est Quant	Bid Unit Price	Bid Price
1	Mobilization / Demobilization	LS	1		
2	Construction Surveying	LS	1		
3	QC and Testing Agency Services	LS	1		
4	Prepare and Implement SWPPP	LS	1		
5	Construct RMP "Customer to Install" Offsite & Onsite Electrical Facilities.	LS	1		
6	Pay for RMP to Complete Onsite and Offsite Electrical Power Supply.	LS	1	Amount issued by addendum	Amount issued by addendum
7	Replace Native Soils Under Pump Station with Structural Fill	LS	1		
8	16" RJ DIP Water Pipeline (Zone 2)	LF	426		
9	24" RJ DIP Water Pipelines (Zones 1, 2)	LF	860		
10	Air Valve Vault Assembly	EA	2		
11	18" RCP Storm Drain	LF	330		
12	Curb Inlet	EA	2		
13	5' Dia Manhole	EA	1		
14	Ornamental Metal Fence	LF	575		
15	Cantilevered Roller Slide Gate	LS	1		
16	PVC Coated Chain Link Fence, Gate	LF	193		
17	Curb and Gutter	LF	1790		
18	AC Paving: 4" AC over 12" UBC	SQ YD	1,990		
19	16' Wide Driveway (City Det ST-4B)	EA	2		
20	1"-3" Pelican Pt Rock Surfacing	LS	1		
21	1"-2" S Town Cobble Rock Surfacing	LS	1		
22	2"-4" S Town Cobble Rock Surfacing	LS	1		
23	3 Vertical Turbine Pumps & Motors	LS	1		
24	Pump Station Piping Systems	LS	1		
25	Pump Station Structure	LS	1		
26	HVAC System	LS	1		
27	Control Panels, SCADA, Programming & Integration	LS	1	<b>\$58,172</b>	<b>\$58,172</b>
28	Electrical & Control Systems (except for items 5, 6, 16, 24, 27, 28, 30, 31)	LS	1		
29	Surge Tanks System	LS	1		
30	Backup Electrical Generator System	LS	1		
<b>Total Base Bid</b>				<b>\$</b>	

## **ARTICLE 6 - TIME OF COMPLETION**

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damage.

## **ARTICLE 7 - ATTACHEMENTS TO THIS BID**

7.01 The following documents are attached to and made a condition of the Bid:

- A. Required Bid security in the form of a Bid Bond (EJCDC No. C-430) or Certified Check),
- B. Contractor's Qualifications and Experience (Section 00 45 13)
- C. Document 00 45 00 - List of Subcontractors,
- D. Evidence of authority to do business in the state or jurisdiction of the Project; or a written covenant to obtain such license within the time frame for acceptance of Bids.

## **ARTICLE 8 - DEFINED TERMS**

8.01 The terms used in this Bid with the initial capital letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

## ARTICLE 9 - BID SUBMITTAL

9.01 This Bid is submitted by:

If Bidder is:

### **An Individual**

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

By: \_\_\_\_\_  
(Individual's signature)

SEAL,  
if required  
by State

Doing business as:  
\_\_\_\_\_

### **A Partnership**

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

By: \_\_\_\_\_  
(Signature of general partner -- attach evidence of authority to sign)

SEAL,  
if required  
by State

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

### **A Corporation**

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

State or Jurisdiction of Incorporation: \_\_\_\_\_

Type (General Business, Profession, Service, Limited Liability):  
\_\_\_\_\_

By: \_\_\_\_\_  
(Signature -- attach evidence of authority to sign)

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

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

Attest \_\_\_\_\_  
(Signature of Corporate Secretary)

CORPORATE  
SEAL,  
if required by State

Date of Qualification to do business in \_\_\_\_\_ [State or other jurisdiction where  
Project is located] is \_\_\_\_/\_\_\_\_/\_\_\_\_



**A Joint Venture**

Name of Joint Venture: \_\_\_\_\_

First Joint Venture Name: \_\_\_\_\_

SEAL,  
if required  
by State

By: \_\_\_\_\_  
(Signature of joint venture partner -- attach evidence of authority to sign)

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

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

Second Joint Venture Name: \_\_\_\_\_

SEAL,  
if required  
by State

By: \_\_\_\_\_  
(Signature of joint venture partner -- attach evidence of authority to sign)

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

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

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is party to the venture should be in the manner indicated above.)

Bidder's Business address: \_\_\_\_\_

Business Phone No. (\_\_\_\_)\_\_\_\_\_

Business E-Mail Address \_\_\_\_\_

State Contractor License No. \_\_\_\_\_. (If applicable)

Employer's Tax ID No. \_\_\_\_\_

Phone Numbers and Address for receipt of official communications, if different from  
Business contact information: \_\_\_\_\_

9.02 Bid submitted on \_\_\_\_\_, 20\_\_\_\_.

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**SECTION 00 43 13**

**BID BOND**

**BID BOND (PENAL SUM FORM)**

<b>Bidder</b> Name: Address <i>(principal place of business)</i> :	<b>Surety</b> Name: Address <i>(principal place of business)</i> :
<b>Owner</b> Name: <b>City of Saratoga Springs, UT.</b> Address <i>(principal place of business)</i> : <b>1307 N. Commerce Dr. #200</b> <b>Saratoga Springs, Utah 84045</b>	<b>Bid</b> Project <i>(name and location)</i> : <b>Drinking Water Booster #8</b> <b>131 S Foothill Blvd</b> <b>Saratoga Springs, UT 85045</b>  Bid Due Date:
<b>Bond</b> Penal Sum: Date of Bond:	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	
Bidder	Surety
<hr/> <i>(Full formal name of Bidder)</i>	<hr/> <i>(Full formal name of Surety) (corporate seal)</i>
By: <hr/> <i>(Signature)</i>	By: <hr/> <i>(Signature) (Attach Power of Attorney)</i>
Name: <hr/> <i>(Printed or typed)</i>	Name: <hr/> <i>(Printed or typed)</i>
Title: <hr/>	Title: <hr/>
Attest: <hr/> <i>(Signature)</i>	Attest: <hr/> <i>(Signature)</i>
Name: <hr/> <i>(Printed or typed)</i>	Name: <hr/> <i>(Printed or typed)</i>
Title: <hr/>	Title: <hr/>
Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.	

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
  - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
  - 3.2. All Bids are rejected by Owner, or
  - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

- END OF SECTION -

**SECTION 00 45 13**

**THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS**

- |    |  |
|----|--|
| 1. | <b>SUBMITTED BY:</b><br>Official Name of Firm: _____<br><br>Address: _____<br>_____<br>_____<br>_____  |
| 2. | <b>SUBMITTED TO:</b> <u>Saratoga Springs</u>   |
| 3. | <b>SUBMITTED FOR:</b> _____<br><br>Owner: <u>Saratoga Springs</u><br><br>Project Name: <u><b>Drinking Water Booster #8</b></u><br><br><b>TYPE OF WORK:</b> <u>Construction of a 4700 gpm vertical turbine booster pump station,</u><br><u>with masonry building, sloped metal seam roof, valves, piping,</u><br><u>HVAC, electrical and controls, site fills, grading.</u> |
| 4. | <b>CONTRACTOR'S CONTACT INFORMATION</b><br><br>Contact Person: _____<br><br>Title: _____<br><br>Phone: _____<br><br>Email: _____   |
| 5. | <b>AFFILIATED COMPANIES:</b><br><br>Name: _____<br><br>Address: _____<br>_____<br>_____  |

**6. CONSTRUCTION EXPERIENCE:**

Previous Experience:

List on **Schedule A** minimum of four (4) similar projects completed within the last 10 Years (If Joint Venture list each participant's projects separately). Include at least two (2) pump stations of similar or larger size. Of the projects listed at least two (2) projects shall have been for drinking water systems.

Has firm listed in Section 1 ever failed to complete a construction contract awarded to it?

☐ YES ☐ NO

If YES, attach as an Attachment details including Project Owner's contact information.

Has any Corporate Officer, Partner, Joint Venture participant or Proprietor ever failed to complete a construction contract awarded to them in their name or when acting as a principal of another entity?

☐ YES ☐ NO

If YES, attach as an Attachment details including Project Owner's contact information.

Are there any judgments, claims, disputes or litigation pending or outstanding involving the firm listed in Section 1 or any of its officers (or any of its partners if a partnership or any of the individual entities if a joint venture)?

☐ YES ☐ NO

If YES, attach as an Attachment details including Project Owner's contact information.

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HERewith, INCLUDING ANY ATTACHMENTS, IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME OF ORGANIZATION: \_\_\_\_\_

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_

DATED: \_\_\_\_\_

**REQUIRED ATTACHMENTS**

1. Schedule A (Previous Experience).
2. Resumes of officers and key individuals (including Safety Officer) of firm named in Section 1.
3. Required safety program submittals listed in Section 7.
4. Additional items as pertinent.

SCHEDULE A

PREVIOUS EXPERIENCE

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				





**DOCUMENT 00 45 16**  
**LIST OF SUBCONTRACTORS**

The bidder shall list below the names and business address of each subcontractor who will perform Work under this Contract in excess of five percent (0.05) of the total bid price and shall also list the portion of the work which will be done by such subcontractor. After the opening of proposals, no changes or substitutions will be allowed without the written approval of the Owner.  
NOTE: Attach additional sheets if required.

<u>WORK TO BE PERFORMED</u>	<u>SUBCONTRACTOR'S NAME AND ADDRESS</u>
1. _____ _____	_____ _____
2. _____ _____	_____ _____
3. _____ _____	_____ _____
4. _____ _____	_____ _____
5. _____ _____	_____ _____
6. _____ _____	_____ _____

- END OF DOCUMENT -

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# **PART 2**

## **CONTRACT FORMS**

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**SECTION 00 51 00**  
**NOTICE OF AWARD**

Date: \_\_\_\_\_

Project: City of Saratoga Springs – DRINKING WATER BOOSTER #8

Owner: City of Saratoga Springs

Owner's Contract No.:

Contract: DRINKING WATER BOOSTER #8

Engineer's Project No.: 360.39.100

Bidder:

Bidder's Address:

You are notified that your Bid dated \_\_\_\_\_ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for **DRINKING WATER BOOSTER #8**.

*Total Work*

The Contract Price of your Contract is: \_\_\_\_\_

Three copies of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within 15 days of the date you receive this Notice of Award.

1. Deliver to the Owner three fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified in the Instructions to Bidders (Article 20), General Conditions (Paragraph 5.01), and Supplementary Conditions (Paragraph SC-5.01).
3. Other conditions precedent: N/A

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Contract Documents.

\_\_\_\_\_  
City of Saratoga Springs  
Owner  
By: \_\_\_\_\_  
Authorized Signature  
\_\_\_\_\_  
Title

Copy to Engineer  
02/2023  
360.39.100

NOTICE OF AWARD  
00 51 00 - 1

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**SECTION 00 52 00**  
**AGREEMENT BETWEEN OWNER AND CONTRACTOR**  
**FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)**

This Agreement is by and between City of Saratoga Springs ("Owner") and \_\_\_\_\_ ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

**ARTICLE 1—WORK**

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

*The construction of a drinking water booster pumping station, with five (5) pump cans and process lines (ultimate 9200 gpm flow), with three (3) of the process lines functionally complete with pumps, 100 hp motors, and valves (for 4700 gpm this contract capacity). A future contract will complete other 2 process lines and add 2 pumps and 250 HP motors. Work includes providing a 2200 foot extension of RMP power to site and removing +/-14 feet of collapsible clays below pump station and refilling with structural backfill; steel and DIP piping, 2 bladder type surge tanks; valves (automated and manual), flow meters, fittings and appurtenances; masonry block building with standing seam metal roofing; HVAC system; site work, grading, drainage facilities, asphalt paving, concrete walks, curb and gutter, rock surfacing; 24- and 16-inch inlet/outlet DIP pipelines with air valve vaults and connections to existing pipes; electrical, instrumentation, and control systems, standby emergency generator, wiring, telemetry, Owner-provided RTU, light poles, motorized gate, chain link and ornamental fencing, conduits for future security system, and other work.*

**ARTICLE 2—THE PROJECT**

- 2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **DRINKING WATER BOOSTER #8.**

**ARTICLE 3—ENGINEER**

- 3.01 The Owner will assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.
- 3.02 The part of the Project that pertains to the Work has been designed by Hansen, Allen & Luce Engineers.

**ARTICLE 4—CONTRACT TIMES**

- 4.01 *Time is of the Essence*
- A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

#### 4.02 *Contract Times: Dates*

- A. The Work will be substantially complete on or before **July 1, 2024** and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **July 31, 2024**.

#### 4.04 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
  - 1. *Substantial Completion*: Contractor shall pay Owner **\$500** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
  - 2. *Completion of Remaining Work*: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner **\$250** for each day that expires after such time until the Work is completed and ready for final payment.
  - 3. Liquidated damages for failing to timely attain Substantial Completion, and final completion are not additive, and will not be imposed concurrently.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

### **ARTICLE 5—CONTRACT PRICE**

- 5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

- A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

### **ARTICLE 6—PAYMENT PROCEDURES**

#### 6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

#### 6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 1st day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted



in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.
  - a. 95 percent of the value of the Work completed (with the balance being retainage).
  - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 97.5 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 100 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

#### 6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

#### 6.04 *Consent of Surety*

- A. Owner will not make final payment or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

#### 6.05 *Interest*

- A. All amounts not paid when due will bear interest at the rate of N/A percent per annum.

### **ARTICLE 7—CONTRACT DOCUMENTS**

#### 7.01 *Contents*

- A. The Contract Documents consist of all of the following:
  1. This Agreement.
  2. Bonds:
    - a. Performance bond (together with power of attorney).
    - b. Payment bond (together with power of attorney).
  3. General Conditions.
  4. Supplementary Conditions.
  5. Specifications as listed in the table of contents of the project manual (copy of list attached).

6. Drawings (not attached but incorporated by reference) with each sheet bearing the following general title: Zone 5 South Pump Station.
8. Addenda (numbers \_\_\_\_ to \_\_\_\_ inclusive).
9. Exhibits to this Agreement (enumerated as follows):
  - a. Contractor's Bid.
  - b. Documentation submitted by Contractor prior to Notice of Award.
10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
  - a. Notice to Proceed.
  - b. Work Change Directives.
  - c. Change Orders.
  - d. Field Orders.
  - e. Warranty Bond, if any.
- B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 7.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

## **ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS**

### **8.01 Contractor's Representations**

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
  1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
  2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
  3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
  4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
  5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in

the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, 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.
8. 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.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract 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.

#### 8.02 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:
  1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
  2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
  3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on \_\_\_\_\_ (which is the Effective Date of the Contract).

Owner:

**City of Saratoga Springs**

*(typed or printed name of organization)*

By:

*(individual's signature)*

Date:

*(date signed)*

Name:

*(typed or printed)*

Title:

*(typed or printed)*

Attest:

*(individual's signature)*

Title:

*(typed or printed)*

Address for giving notices:

**1307 N Commerce Dr #200**

**Saratoga Springs, UT 84045**

Designated Representative:

Name:

*(typed or printed)*

Title:

*(typed or printed)*

Address:

Phone:

Email:

*(If **Owner** is a corporation, attach evidence of authority to sign. If **Owner** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*

Contractor:

*(typed or printed name of organization)*

By:

*(individual's signature)*

Date:

*(date signed)*

Name:

*(typed or printed)*

Title:

*(typed or printed)*

*(If **Contractor** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest:

*(individual's signature)*

Title:

*(typed or printed)*

Address for giving notices:

Designated Representative:

Name:

*(typed or printed)*

Title:

*(typed or printed)*

Address:

Phone:

Email:

License No.:

*(where applicable)*

State:

- END OF SECTION -

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**SECTION 00 55 00  
NOTICE TO PROCEED**

Date: \_\_\_\_\_

Project: DRINKING WATER BOOSTER #8

Owner: City of Saratoga Springs

Owner's Contract No.: N/A

Contract: DRINKING WATER BOOSTER #8

Engineer's Project No.: 360.39.100

Contractor:

Contractor's Address:

You are notified that the Contract Times under the above Contract will commence to run \_\_\_\_\_, 2023. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Substantial Completion is \_\_\_\_\_, and the date of readiness for final payment is \_\_\_\_\_.

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds and loss payees) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must:

- Execute Contract document provided by the City
- Apply for and receive an approved City Encroachment permit.

Owner: City of Saratoga Springs

Given by:

Authorized Signature

Title

Date

Copy to Engineer

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**SECTION 00 61 00**  
**PERFORMANCE BOND**

<b>Contractor</b> Name: Address <i>(principal place of business)</i> :	<b>Surety</b> Name: Address <i>(principal place of business)</i> :
<b>Owner</b> Name: <b>City of Saratoga Springs</b> Mailing address <i>(principal place of business)</i> : <b>1307 N Commerce Dr #200</b> <b>Saratoga Springs, UT 84045</b>	<b>Contract</b> Description <i>(name and location)</i> : <b>Drinking Water Booster #8</b> <b>131 S Foothill Blvd.</b> <b>Saratoga Springs, UT 84045</b> Contract Price: Effective Date of Contract:
<b>Bond</b> Bond Amount: Date of Bond: <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 16	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <div style="text-align: center;"><i>(Signature)</i></div>	By: _____ <div style="text-align: center;"><i>(Signature)(Attach Power of Attorney)</i></div>
Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>	Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>
Title: _____	Title: _____
Attest: _____ <div style="text-align: center;"><i>(Signature)</i></div>	Attest: _____ <div style="text-align: center;"><i>(Signature)</i></div>
Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>	Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>
Title: _____	Title: _____
<i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
  - 3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
  - 3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
  - 3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
  - 5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
  - 5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
  - 5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
  - 5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

- 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
  - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
- 6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.
- 7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
  - 7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
  - 7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
  - 7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
- 8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
- 9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
- 10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
- 11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.
- 12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.
- 13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

- 14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
  - 14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
  - 14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
  - 14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
  - 14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows: None

- END OF SECTION -

**SECTION 00 61 50****PAYMENT BOND**

<b>Contractor</b> Name: Address <i>(principal place of business)</i> :	<b>Surety</b> Name: Address <i>(principal place of business)</i> :
<b>Owner</b> Name: <b>City of Saratoga Springs</b> Mailing address <i>(principal place of business)</i> : <b>1304 N Commerce Dr #200</b> <b>Saratoga Springs, UT 84045</b>	<b>Contract</b> Description <i>(name and location)</i> : <b>Drinking Water Booster #8</b> <b>131 S Foothill Blvd.</b> <b>Saratoga Springs, UT 84045</b> Contract Price: Effective Date of Contract:
<b>Bond</b> Bond Amount: Date of Bond: <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 18	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
  - 5.1. Claimants who do not have a direct contract with the Contractor
    - 5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
    - 5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
  - 5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
  - 7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
  - 7.2. Pay or arrange for payment of any undisputed amounts.
  - 7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. Definitions
  - 16.1. *Claim*—A written statement by the Claimant including at a minimum:
    - 16.1.1. The name of the Claimant;
    - 16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;
    - 16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
    - 16.1.4. A brief description of the labor, materials, or equipment furnished;

- 16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
  - 16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
  - 16.1.7. The total amount of previous payments received by the Claimant; and
  - 16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
- 16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
- 16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
- 16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
18. Modifications to this Bond are as follows: None

- END OF SECTION -



**SECTION 00 62 50**  
**CERTIFICATE OF SUBSTANTIAL COMPLETION**

Owner: City of Saratoga Springs  
Engineer: Hansen, Allen & Luce, Inc.  
Contractor:  
Project: DRINKING WATER BOOSTER #8  
Contract:

Owner's Project No.:  
Engineer's Project No.: 360.39.100  
Contractor's Project No.:

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☒ All Work      ☐ The following specified portions of the Work:

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Date of Substantial Completion: \_\_\_\_\_

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Owner's Amended Responsibilities: ☐ None ☐ As follows:

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Contractor's Amended Responsibilities: ☐ None ☐ As follows:

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The following documents are attached to and made a part of this Certificate:

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This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

---

Executed by Engineer

---

Date

---

Accepted by Contractor

---

Date

---

Accepted by Owner

---

Date

**SECTION 00 63 41**  
**CHANGE ORDER FORM**

**CHANGE ORDER NO.:** \_\_\_\_\_

Owner:	City of Saratoga Springs	Owner's Project No.:
Engineer:	Hansen, Allen & Luce, LLC.	Engineer's Project No.: 360.39.100
Contractor:		Contractor's Project No.:
Project:	Drinking Water Booster #8	
Contract Name:		
Date Issued:		Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments:

Change in Contract Price		Change in Contract Times	
Original Contract Price:		Original Contract Times:	
\$ _____		Substantial Completion: _____	
		Ready for final payment: _____	
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. ____:		[Increase] [Decrease] from previously approved Change Orders No.1 to No. ____:	
\$ _____		Substantial Completion: _____	
		Ready for final payment: _____	
Contract Price prior to this Change Order:		Contract Times prior to this Change Order:	
\$ _____		Substantial Completion: _____	
		Ready for final payment: _____	
[Increase] [Decrease] this Change Order:		[Increase] [Decrease] this Change Order:	
\$ _____		Substantial Completion: _____	
		Ready for final payment: _____	
Contract Price incorporating this Change Order:		Contract Times with all approved Change Orders:	
\$ _____		Substantial Completion: _____	
		Ready for final payment: _____	

<b>Recommended by Engineer (if required)</b>	<b>Authorized by Owner</b>
By: _____	_____
Title: _____	_____
Date: _____	_____
_____ Authorized by Owner	_____ Approved by Funding Agency (if applicable)
By: _____	_____
Title: _____	_____
Date: _____	_____

- END OF SECTION -



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# **PART 3**

## **CONTRACT CONDITIONS**

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**SECTION 00 72 00**  
**GENERAL CONDITIONS**

The General Conditions to be used for the Project are the Standard General Conditions of the Construction Contract prepared by Engineers Joint Contract Documents Council (No. EJCDC C-700, 2018 Edition) as included in this Section.

# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

## ARTICLE 1—DEFINITIONS AND TERMINOLOGY

### 1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
  2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
  3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
  4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
  5. *Bidder*—An individual or entity that submits a Bid to Owner.
  6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
  7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
  8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
  9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
  10. *Claim*
    - a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

- requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.
- b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.
  - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
  - d. A demand for money or services by a third party 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. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
21. *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.

22. *Engineer*—The individual or entity named as such in the Agreement.
23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
  - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
  - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
  - c. 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.
25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.
28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.
32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.



33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals.
36. *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 reviewing Contractor’s Applications for Payment.
37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor 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.
38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.
39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers’ instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
46. *Technical Data*
- a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
  - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, 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, 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.
47. *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 but not limited to 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.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

## 1.02 Terminology

- A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:* The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day:* The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:* The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
  - 1. does not conform to the Contract Documents;
  - 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
  - 3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).
- E. *Furnish, Install, Perform, Provide*
  - 1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
  - 2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
  - 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
  - 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

## **ARTICLE 2—PRELIMINARY MATTERS**

### **2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance***

- A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner’s Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

### **2.02 *Copies of Documents***

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed 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.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

### **2.03 *Before Starting Construction***

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:
  - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
  - 2. a preliminary Schedule of Submittals; and
  - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.
  - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
  - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
  - 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
  - 4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting 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 transmittal of the Electronic Documents.

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

### 3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.
- F. 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.
- G. Nothing in the Contract Documents creates:
  - 1. any contractual relationship between Owner or Engineer 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. any obligation on the part of Owner or Engineer 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. *Standards Specifications, Codes, Laws and Regulations*
  - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
  - 2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

### 3.03 *Reporting and Resolving Discrepancies*

#### A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

#### B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
  - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
  - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

### 3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

### 3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
  - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
  - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

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

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

- A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

### 4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

### 4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the



established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

#### 4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
  - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
  - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

#### 4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
  - 1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
  - 2. Abnormal weather conditions;
  - 3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
  - 4. Acts of war or terrorism.

- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
  2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
  3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail 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; and
  5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.
- Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.
- F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses 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.

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

### **5.01 *Availability of Lands***

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

## 5.02 *Use of Site and Other Areas*

### A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
  2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder 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 the Contractor or those for which Contractor is responsible.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.
  - C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

- D. *Loading of Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

### 5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* 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 such reports and drawings.

- 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:* 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.46.b.

- 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 Engineer, 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;
  2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such 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. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

#### 5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:
1. 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;
  2. is of such a nature as to require 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;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer 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. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain 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 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption 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 Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer'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 the Engineer 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; and,
  - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
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;
    - 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 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 will 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 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 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.

#### 5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
  2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
  4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
  5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review:* Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
  2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
  3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
  4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- F. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, 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. 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;
  - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
  - c. Contractor gave the notice required in Paragraph 5.05.B.
2. 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 will be set forth in a Change Order.
  3. 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 Underground Facility in question.
  4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

#### 5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
3. Technical Data contained in such reports and drawings.

B. *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 on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, 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;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
  3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

## **ARTICLE 6—BONDS AND INSURANCE**

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

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

Regulations, and must be issued and signed by a surety named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

#### 6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.
- H. Contractor shall require:
  - 1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
  - 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or 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 Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
  - 1. include at least the specific coverages required;
  - 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
  - 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
  - 4. apply with respect to the performance of the Work, whether such 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; and
  - 5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds:* The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
  - 1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
  - 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
  - 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and
5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

- A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
  2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.
1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

**ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES**

7.01 *Contractor's Means and Methods of Construction*

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has 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. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.



- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

#### 7.04 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

#### 7.05 *"Or Equals"*

- A. *Contractor's Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.
  - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
    - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
      - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

- 2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
  - 3) has a proven record of performance and availability of responsive service; and
  - 4) is not objectionable to Owner.
- b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
    - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
    - 2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

#### 7.06 Substitutes

- A. *Contractor's Request; Governing Criteria:* Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
  2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
  - a. will certify that the proposed substitute item will:
    - 1) perform adequately the functions and achieve the results called for by the general design;
    - 2) be similar in substance to the item specified; and
    - 3) be suited to the same use as the item specified.
  - b. will state:
    - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
    - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
    - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
  - c. will identify:
    - 1) all variations of the proposed substitute item from the item specified; and
    - 2) available engineering, sales, maintenance, repair, and replacement services.
  - d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

- H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights 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 specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights 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 not specified in the Contract Documents.

#### 7.09 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

#### 7.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

#### 7.11 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
- C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

#### 7.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

### 7.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such 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. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
  - 1. all persons on the Site or who may be affected by the Work;
  - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
  - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

- 1. Before submitting a Shop Drawing or Sample, Contractor shall:
  - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
  - b. determine and verify:
    - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
    - 2) the suitability of all 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
    - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
  - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
- 2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.



3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.
1. *Shop Drawings*
    - a. Contractor shall submit the number of copies required in the Specifications.
    - b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.
  2. *Samples*
    - a. Contractor shall submit the number of Samples required in the Specifications.
    - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.
  3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Engineer's Review of Shop Drawings and Samples*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of 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. Engineer'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. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
  4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.
6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.
8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

*D. Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

*E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
  - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
  - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
  - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

- d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
- 2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

**7.17 Contractor's General Warranty and Guarantee**

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.
- B. 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 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
  - 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
  - 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  - 1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
  - 2. normal wear and tear under normal usage.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
  - 1. Observations by Engineer;
  - 2. Recommendation by Engineer or payment by Owner of any progress or final payment;
  - 3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
  - 4. Use or occupancy of the Work or any part thereof by Owner;
  - 5. Any review and approval of a Shop Drawing or Sample submittal;
  - 6. The issuance of a notice of acceptability by Engineer;
  - 7. The end of the correction period established in Paragraph 15.08;
  - 8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.
- E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

**7.18 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 and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment 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, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

**7.19 Delegation of Professional Design Services**

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services 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 Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding 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 7.19;
  - 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 shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

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

### **8.01 *Other Work***

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article 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 4.05.C.3.

#### 8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
  - 1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
  - 2. An itemization of the specific matters to be covered by such authority and responsibility; and
  - 3. The extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

#### 8.03 *Legal Relationships*

- A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.
  - 1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
  - 2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

## **ARTICLE 9—OWNER'S RESPONSIBILITIES**

### **9.01    *Communications to Contractor***

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

### **9.02    *Replacement of Engineer***

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

### **9.03    *Furnish Data***

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

### **9.04    *Pay When Due***

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.



## **ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION**

### **10.01 *Owner's Representative***

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

### **10.02 *Visits to Site***

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

### **10.03 *Resident Project Representative***

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

### **10.04 *Engineer's Authority***

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

**10.05 *Determinations for Unit Price Work***

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

**10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work***

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

**10.07 *Limitations on Engineer's Authority and Responsibilities***

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

**10.08 *Compliance with Safety Program***

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

## ARTICLE 11—CHANGES TO THE CONTRACT

### 11.01 *Amending and Supplementing the Contract*

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All 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 engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

### 11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
  - 1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
  - 2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
  - 3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) 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 (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
  - 4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

### 11.03 *Work Change Directives*

- A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

- B. If Owner has issued a Work Change Directive and:
  - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
  - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

#### 11.04 *Field Orders*

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

#### 11.05 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 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.

#### 11.06 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

#### 11.07 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
  2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
  3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit will be determined as follows:
1. A mutually acceptable fixed fee; or
  2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
    - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
    - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
    - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
    - d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
    - e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
    - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

#### 11.08 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

#### 11.09 *Change Proposals*

- A. *Purpose and Content:* Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

- B. *Change Proposal Procedures*

- 1. *Submittal:* Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
- 2. *Supporting Data:* The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
  - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
  - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

- 3. *Engineer's Initial Review:* Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
- 4. *Engineer's Full Review and Action on the Change Proposal:* Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

#### 11.10 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

### ARTICLE 12—CLAIMS

#### 12.01 *Claims*

- A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
  1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
  2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
  3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
  4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are 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. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation*
  - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
  - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
  - 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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

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

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. 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-fee, time-and-materials, or other cost-based terms; or



2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
  2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
  3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
  4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
  5. Other 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. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

- 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
  - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
  - 3) 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.
- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
  - h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
  - i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- C. *Costs Excluded:* The term Cost of the Work does not include any of the following items:
  - 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, 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.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
  - 2. The cost of purchasing, renting, or furnishing small tools and hand tools.
  - 3. Expenses of Contractor's principal and branch offices 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 negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
  - 6. Expenses incurred in preparing and advancing Claims.
  - 7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.
- D. *Contractor's Fee*
  - 1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
    - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
    - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
      - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
      - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
  - 2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

- E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

### 13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances*: Contractor agrees that:
1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
  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 no demand for additional payment for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

### 13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work 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 comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
  - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
  - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

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

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
  2. to attain Owner's and Engineer'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; and
  5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

#### 14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

#### 14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

#### 14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
  - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
  - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

#### 14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

**14.07 Owner May Correct Defective Work**

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

**ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD**

**15.01 Progress Payments**

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments*
  - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
  - 2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation



establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

*C. Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
  - a. the Work has progressed to the point indicated;
  - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
  - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
  - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
  - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
  - a. to supervise, direct, or control the Work;
  - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
  - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
  - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
  - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
  - a. the Work is defective, requiring correction or replacement;
  - b. the Contract Price has been reduced by Change Orders;
  - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
  - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
  - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

**D. *Payment Becomes Due***

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

**E. *Reductions in Payment by Owner***

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
  - a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

- b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
  - c. Contractor has failed to provide and maintain required bonds or insurance;
  - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
  - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
  - f. The Work is defective, requiring correction or replacement;
  - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
  - h. The Contract Price has been reduced by Change Orders;
  - i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
  - j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
  - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or
  - l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
  3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

#### 15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

#### 15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

#### 15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

#### 15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

#### 15.06 *Final Payment*

##### A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must be accompanied (except as previously delivered) by:
  - a. all documentation called for in the Contract Documents;
  - b. consent of the surety, if any, to final payment;
  - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

- d. a list of all duly pending Change Proposals and Claims; and
  - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
- 3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.
- B. *Engineer's Review of Final Application and Recommendation of Payment:* If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.
- C. *Notice of Acceptability:* In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due:* Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

#### 15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

#### 15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
  - 1. correct the defective repairs to the Site or such adjacent areas;
  - 2. correct such defective Work;
  - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
  - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

## **ARTICLE 16—SUSPENSION OF WORK AND TERMINATION**

### **16.01 *Owner May Suspend Work***

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

### **16.02 *Owner May Terminate for Cause***

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);
  2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
  3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
  4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and
  2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,



attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

#### 16.03 *Owner May Terminate for Convenience*

- A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
  - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
  - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
  - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

#### 16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. 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 or otherwise for expenses or 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. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this article:
  - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
  - 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this article, Owner or Contractor may:
  - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
  - 2. agree with the other party to submit the dispute to another dispute resolution process; or
  - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

## **ARTICLE 18—MISCELLANEOUS**

### **18.01 *Giving Notice***

- A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
  - 1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
  - 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
  - 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

### **18.02 *Computation of Times***

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, 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.

18.09 *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 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.



**SECTION 00 80 00**  
**SUPPLEMENTARY CONDITIONS**  
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**SECTION 00 80 00**  
**SUPPLEMENTARY CONDITIONS**

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). 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, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, "Paragraph SC-4.05."

**ARTICLE 1—DEFINITIONS AND TERMINOLOGY**

No suggested Supplementary Conditions in this Article.

**ARTICLE 2—PRELIMINARY MATTERS**

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

SC-2.01   Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

- B. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- C. *Evidence of Owner's Insurance:* After receipt from Contractor of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner in this Contract (if any). Owner 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***

SC-2.02   Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

- A. Owner shall furnish to Contractor one electronic portable document format (PDF) copy of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement).

**2.06   *Electronic Transmittals***

SC-2.06   Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

- B. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol ("EDP" or "Protocol") for exchange of electronic transmittals.

1. *Basic Requirements*

- a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.
- b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.
- c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
- d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.
- e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.
- f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

- a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.
  - 1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 40 MB. Attachments larger than that may be exchanged using large file transfer functions or physical media.
  - 2) Each Party assumes full and complete responsibility for any and all of 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, for use with respect to this EDP.

- b. Each party 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 the party's 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.
- c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party 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. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.
- d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.
- e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.
- f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.
- g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.
- h. The Owner will operate a Project information management system (also referred to in this EDP as "Project Website") for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph



will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information. The following conditions and standards will govern use of the Project Website:

- 1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;
- 2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;
- 3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and
- 4) Include any other Project Website attributes that may be pertinent to Contractor's use of the facility and pricing of such use.

C. *Software Requirements for Electronic Document Exchange; Limitations*

1. Each party will 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 software formats required in this section of the EDP.
  - a. 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 adjust its transmission to comply with this EDP.
2. 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.
3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

SC-2.06 Supplement Paragraph 2.06 of the General Conditions by adding the following paragraph:

D. *Requests by Contractor for Electronic Documents in Other Formats*

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.
2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:
  - a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for

Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

- b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.
  - c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.
  - d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.
3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at \$[number] per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

### **ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE**

#### **3.01 Intent**

SC-3.01 Delete Paragraph 3.01.C in its entirety.

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

#### **4.05 Delays in Contractor's Progress**

SC-4.05 A Amend Paragraph 4.05.A by removing the following words:

"Contract Price"

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. *Weather-Related Delays*

- a. If “abnormal weather conditions” as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled.
- b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:
  - 1) Every workday on which one or more of the following conditions exist will be considered a “bad weather day”:
    - i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds **0.25 inch** of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference.
    - ii) Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: **25 degrees Fahrenheit**; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: **95 degrees Fahrenheit**.
    - iii) Abnormal temperatures or rainfall conditions which created muddy conditions preventing construction vehicles from functioning in a typical manner or leading to the creation of excessive mud on public roads.
  - 2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded daily by **City inspector or engineer using mobile phones providing weather data for the location of the project site.**
  - 3) Contractor shall anticipate **two** Foreseeable Bad Weather Days each month on weekdays.
  - 4) In each month, every Bad Weather day exceeding the number of foreseeable bad weather days will be considered as “abnormal weather conditions.” The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor’s then-current Progress Schedule’s critical path for the Project.

## ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

### 5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

- E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

<b>Geotechnical Report date 7/11/22</b>		

- F. The following table lists the 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 specifically identifies the Technical Data upon which Contractor may rely:

<b>None</b>		

- G. Contractor may request from the Engineer copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents.

### 5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. 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:

<b>None</b>		

5. 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

<b>None</b>		

## ARTICLE 6—BONDS AND INSURANCE

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

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.B:

1. After Substantial Completion, Contractor shall furnish a warranty bond issued in the form of EJCDC® C-612, Warranty Bond (2018). The warranty bond must be in a bond amount of **10** percent of the final Contract Price. The warranty bond period will extend to a date **1** year after Substantial Completion of the Work. Contractor shall deliver the fully executed warranty bond to Owner prior to or with the final application for payment, and in any event no later than 11 months after Substantial Completion.
3. The warranty bond must be issued by the same surety that issues the performance bond required under Paragraph 6.01.A of the General Conditions.

#### 6.02 Insurance—General Provisions

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.
2. Contractor shall be required to have insurance pursuant to the City of Saratoga Springs insurance limits and coverages identified in Exhibit \_\_\_\_\_

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.H.2 of the General Conditions:

3. For the following Subcontractors, Suppliers, or categories of Subcontractor or Supplier, Contractor shall require the following specified insurance, with policy limits as stated:

#### 6.03 Contractor's Insurance

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

- D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following:
- E. *Workers' Compensation and Employer's Liability:* Contractor shall 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 (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory

<b>Workers' Compensation and Related Policies</b>	<b>Policy limits of not less than:</b>
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
<b>Employer's Liability</b>	
Each accident	\$100,000
Each employee	\$100,000
Policy limit	\$500,000
<b>Stop-gap Liability Coverage</b>	

- F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
  2. damages insured by reasonably available personal injury liability coverage, and
  3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
    - a. Such insurance must be maintained for three years after final payment.
    - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
  2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
  3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
  4. Underground, explosion, and collapse coverage.
  5. Personal injury coverage.
  6. 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). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
  7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

- H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification 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).
  2. Any exclusion for water intrusion or water damage.
  3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
  4. Any exclusion of coverage relating to earth subsidence or movement.
  5. Any exclusion for the insured’s vicarious liability, strict liability, or statutory liability (other than worker’s compensation).
  6. Any limitation or exclusion based on the nature of Contractor’s work.
  7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.
- I. *Commercial General Liability—Minimum Policy Limits*

<b>Commercial General Liability</b>	<b>Policy limits of not less than:</b>
General Aggregate	\$2,000,000
Bodily Injury and Property Damage—Each Occurrence	\$100,000

- J. *Automobile Liability:* Contractor shall 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.

<b>Automobile Liability</b>	<b>Policy limits of not less than:</b>
<b>Bodily Injury</b>	
Each Accident	\$1,000,000
<b>Property Damage</b>	
Each Accident	\$1,000,000

- K. L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer’s liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy’s policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of **\$3,000,000** after accounting for partial attribution of its limits to underlying policies, as allowed above.

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).
  - a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
  - b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.
2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).
4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of **\$500,000**
5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of **\$500,000**.
6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
8. include performance/hot testing and start-up, if applicable.



9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:
  - a. City officers, officials, employees, and volunteers.
11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:
12. If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit, such sublimit will be a minimum of **\$250,000**.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

- H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.
  1. The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount of no more than **\$25,000** for direct physical loss in any one occurrence.

## ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

### 7.03 *Labor; Working Hours*

SC-7.03 Delete Paragraph 7.03.C in its entirety, and insert the following:

- C. In the absence of any Laws or Regulations to the contrary, Contractor may perform the Work on holidays, during any or all hours of the day, and on any or all days of the week, at Contractor's sole discretion.

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

- D. **Owner** shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

### 7.10 *Taxes*

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

- A. Owner is exempt from payment of sales and compensating use taxes of the State of **Utah** and of cities and counties thereof on all materials to be incorporated into the Work.
  - 1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
  - 2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

## ARTICLE 8—OTHER WORK AT THE SITE

No suggested Supplementary Conditions in this Article.

## ARTICLE 9—OWNER'S RESPONSIBILITIES

### 9.13 *Owner's Site Representative*

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

### 9.13 *Owner's Site Representative*

- A. Owner will furnish an "Owner's Site Representative" to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner's Site Representative is not Engineer's consultant, agent, or employee. Owner's Site Representative will be **a City Inspector**. The authority and responsibilities of Owner's Site Representative **shall be the same as is they were the Resident Project Representative**.

## ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

### 10.03 *Resident Project Representative*

SC-10.03 Add the following new subparagraph immediately after Paragraph 10.03.A:

- 1. On this Project, by agreement with the Owner, the Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
  - 1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
3. *Liaison*
  - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
  - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
  - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
4. *Review of Work; Defective Work*
  - a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02 if the Work is in general proceeding in accordance with the Contract Documents.
  - b. Observe whether any Work in place appears to be defective.
  - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
5. *Inspections and Tests*
  - a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
  - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
6. *Payment Requests:* Review Applications for Payment with Contractor.
7. *Completion*
  - a. Participate in Engineer's visits regarding Substantial Completion.
  - b. Assist in the preparation of a punch list of items to be completed or corrected.
  - c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
  - d. Observe whether items on the final punch list have been completed or corrected.
- D. The RPR will not:
  1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
  2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
  3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Authorize Owner to occupy the Project in whole or in part.

#### **ARTICLE 11—CHANGES TO THE CONTRACT**

No suggested Supplementary Conditions in this Article.

#### **ARTICLE 12—CLAIMS**

No suggested Supplementary Conditions in this Article.

#### **ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK**

No suggested Supplementary Conditions in this Article.

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

No suggested Supplementary Conditions in this Article.

#### **ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD**

##### **15.01 *Progress Payments***

SC-15.01 Add the following new Paragraph 15.01.D:

- F. Owner shall make payment within 30 days of receipt of Engineer's recommendation of payment of a progress payment.

#### **ARTICLE 16—SUSPENSION OF WORK AND TERMINATION**

No suggested Supplementary Conditions in this Article.

#### **ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES**

##### **17.02 *Arbitration***

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

##### **17.02 *Arbitration***

- A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of \$100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.
- B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.
- C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.
- D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.
- E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.
- F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.
- G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:
  - 1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;
  - 2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;
  - 3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and

4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.
- H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.
- I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02. [Note: If there is no Paragraph 17.02, because neither arbitration nor any other dispute resolution process has been specified here in the Supplementary Conditions, then revise this to state "Add the following new Paragraph immediately after Paragraph 17.01" and revise the numbering accordingly].

17.03 *Attorneys' Fees*

- A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

**ARTICLE 18—MISCELLANEOUS**

No suggested Supplementary Conditions in this Article.

**EXHIBIT A—SOFTWARE REQUIREMENTS FOR ELECTRONIC DOCUMENT EXCHANGE**

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contactors Submittals (Shop Drawings, "or equal" requests, substitution requests, documentation accompanying Sample submittals and other submittals) to Owner and Engineer, and Owner's and Engineer's responses to Contractor's Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version. Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from Contractor to Owner or Engineer and for responses from Engineer and Owner to Contractor regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	EXC	
a.8	Database files and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	DB	
Notes				
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.			
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.			
Key				

Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)
PDF	Portable Document Format readable
DWG	Autodesk® AutoCAD .dwg format Version <b>2019 or more recent</b>
DOC	Microsoft® Word .docx format Version <b>Microsoft 365 or compatible</b>
EXC	Microsoft® Excel .xls or .xml format Version <b>Microsoft 365 or compatible</b>



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# **PART 4**

## **TECHNICAL SPECIFICATIONS**

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**SECTION 01 11 00**  
**SUMMARY OF WORK**

**PART 1 GENERAL**

**1.1 GENERAL**

- A. The Work to be performed under this Project shall consist of furnishing all labor, materials, and equipment necessary or required to complete the work in all respects as shown on the Contract Drawings and as herein specified. All work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary to complete the construction of the work in good faith shall be performed, furnished, and installed by CONTRACTOR as though originally so specified or shown, at no increase in cost to OWNER.

**1.2 WORK COVERED BY CONTRACT DOCUMENTS**

- A. *The construction of a drinking water booster pumping station, with five (5) pump cans and process lines (ultimate 9200 gpm flow), with three (3) of the process lines functionally complete with pumps, 100 hp motors, and valves (for 4700 gpm this contract capacity). A future contract will complete other 2 process lines and add 2 pumps and 250 HP motors. Work includes providing an extension of RMP power to site and removing +/-14 feet of collapsible clays below pump station and refilling with structural backfill; steel and DIP piping, 2 bladder type surge tanks; valves (automated and manual), flow meters, fittings and appurtenances; masonry block building with standing seam metal roofing; HVAC system; site work, grading, drainage facilities, asphalt paving, concrete walks, curb and gutter, rock surfacing; 24- and 16-inch inlet/outlet DIP pipelines with air valve vaults and connections to existing pipes; electrical, instrumentation, and control systems, standby emergency generator, wiring, telemetry, Owner-provided RTU, light poles, motorized gate, chain link and ornamental fencing, conduits for future security system, and other work.*
- B. The work is located by Utah Lake Distribution Canal, about 1000 feet southeast of the intersection of Foothill Blvd and Pony Express Blvd in Saratoga Springs, Utah.

**1.3 CONTRACT METHOD**

- A. The Work hereunder will be constructed under a single unit price contract.

**1.4 CONTRACTOR USE OF PROJECT SITE**

- A. CONTRACTOR's use of the Project Site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities.

**1.5 PROJECT SECURITY**

- A. CONTRACTOR shall make all necessary provisions to protect the Project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.

## **1.6 CITY STANDARDS**

- A. Comply with City of Saratoga Springs Standards and these project specifications. If there is disagreement, the more stringent requirements apply.

## **1.7 CHANGES IN THE WORK**

- A. It is mutually understood that it is inherent in the nature of public works construction that some changes in the plans and specifications may be necessary during the course of construction to adjust them to unforeseen field conditions, and that it is of the essence of the Contract to recognize a normal and expected margin of change. ENGINEER shall have the right to make such changes, from time to time, in the plans, in the character of the Work, and in the scope of the Project as may be necessary or desirable to ensure the completion of the Work in the most satisfactory manner without invalidating the Contract.

**PART 2        PRODUCTS (Not Used)**

**PART 3        EXECUTION (Not Used)**

- END OF SECTION -

**SECTION 01 14 00**  
**WORK RESTRICTIONS**

**PART 1 GENERAL**

- A. OWNER and/or utility owners may be working within the Project area while this contract is in progress. If so, CONTRACTOR shall schedule Work in conjunction with these other entities to minimize mutual interference.
- B. All compaction and other testing requirements specified shall be provided and paid for by CONTRACTOR.
- C. Per Section 01 45 00, Quality Control and Materials Testing, CONTRACTOR shall accommodate City requests for supplemental quality control testing of the Work.
- D. CONTRACTOR shall notify owners of Private rights-of-way 72 hours prior to work being performed across owner's right-of-way.
- E. If required to work in City Streets or Utah Department of Transportation (UDOT) right-of-way, CONTRACTOR shall notify right-of-way owner 72 hours prior to work being performed therein. Work within the City Streets or UDOT right-of-way shall be in accordance with required permits and any license agreement with OWNER. CONTRACTOR shall obtain and comply with all required permits.
- F. CONTRACTOR must work with all adjacent property owners to ensure no harm or damage is caused to homes or property during construction of the project.

**1.2 MEASUREMENT AND PAYMENT**

- A. Work Restrictions shall not be measured or paid as a separate item but shall be included as part of the various items to which it relates.

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION (Not Used)**

- END OF SECTION -

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**SECTION 01 22 00**  
**MEASUREMENT AND PAYMENT**

**PART 1 GENERAL**

**1.1 REQUIREMENTS**

- A. All work completed under this contract shall be in accordance with the Contract Drawings and Specifications and will be measured by ENGINEER/OWNER. The quantities appearing on the Bid Schedule are approximate only and are prepared for the comparison of bids. Payment to CONTRACTOR on bid items with unit prices other than "Lump Sum" will be made for actual quantities of work performed and accepted, or material furnished in accordance with the Contract. The scheduled quantities of work to be done and materials to be furnished may be increased or decreased in accordance with the General Conditions.
- B. The term "Lump Sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure, portion of work, or unit is specified "Lump Sum" as the unit of measurement, the unit will include fittings, accessories, and all work necessary to complete the work as shown on the Drawings and as specified.
- C. Unit Price Payment" Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of an item of the Work; and overhead and profit.
- D. When the accepted quantities of work vary from the quantities in the Bid Schedule, CONTRACTOR shall accept as payment in full, so far as contract items are concerned, payment at the original contract unit prices for the work done. OWNER reserves the right to add to or delete from quantities listed in the bid schedule in order to match the total bid with the budgeted money available.

**1.2 BASE BID SCHEDULE**

- A. Payments will be as described below, less retainage amounts described in the General Conditions. Retainage amounts will be released as described in the General Conditions
- B. **BID ITEM NO. 1 – "MOBILIZATION / DEMOBILIZATION"**
  - 1. **GENERAL.** "Mobilization/Demobilization" includes general and miscellaneous responsibilities and operations not normally attributed to any other single bid item. It includes, but is not limited to, work described in Section 01 71 13 – Mobilization.
  - 2. **METHOD OF MEASUREMENT.** "Mobilization/Demobilization" will be measured based on percent of total work in Bid Schedule completed as required in Section 01 71 13 - Mobilization.
  - 3. **BASIS OF PAYMENT.** Payment for "Mobilization/Demobilization" will be made at the lump sum bid amount in Bid Schedule will be as follows:
    - a. When 10% of the original contract amount is earned, 25% of the amount bid for mobilization will be paid.
    - b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for mobilization will be paid.
    - c. When 50% of the original contract amount is earned, an additional 25% for a total

- of 75% of the amount bid for mobilization will be paid.
- d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for mobilization will be paid.

**C. BID ITEM NO. 2 – “CONSTRUCTION SURVEYING”**

1. **GENERAL.** Contractor work to provide all “Construction Surveying” per Section 01 30 00 Administrative Requirements, performed by a registered professional land surveyor.
2. **METHOD OF MEASUREMENT.** “Construction Surveying” will be measured based on percent of work complete.
3. **BASIS OF PAYMENT.** Payment for “Construction Surveying” lump sum bid amount in Bid Schedule will be as follows:
  - a. When 5% of the original contract amount is earned, 75% of the amount bid for construction surveying will be paid.
  - b. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for construction surveying will be paid.

**D. BID ITEM NO. 3 – “QC AND TESTING AGENCY SERVICES”**

1. **GENERAL.** This item is for Contractor's QC Work and Testing Agency Services, including, but not limited to, all work in Sections 01 45 23 and 01 45 00.
2. **METHOD OF MEASUREMENT.** It will be measured based on percent of successful QC testing work complete which is based on the percent of total Contract work complete (tested and accepted).
3. **BASIS OF PAYMENT.** Payment of this lump sum bid amount will be as follows:
  - a. When 10% of the original contract amount is earned, 25% of the amount bid for material testing will be paid.
  - b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for material testing will be paid.
  - c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for material testing will be paid.
  - d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for material testing will be paid.

**E. BID ITEM NO. 4 – “PREPARE AND IMPLEMENT STORM WATER POLLUTION PREVENTION PLAN”**

1. **METHOD OF MEASUREMENT.** “Preparation and Implementation of the Storm Water Pollution Prevention Plan” shall be measured and paid for on a lump sum basis for the implementation of the approved Plan as completed by CONTRACTOR.
2. **BASIS OF PAYMENT.** “Preparation and Implementation of the Storm Water Pollution Prevention Plan” shall be paid for at the lump sum bid price as a percentage of work completed. Payment shall be considered full compensation for obtaining required permits and complying with all City, State, and Federal storm water management regulations and requirements, including preparation and implementing the Storm Water Pollution Prevention Plan (SWPPP) for Construction Activities. Payment includes CONTRACTOR preparing the SWPPP, including obtaining and inserting the Notice of Intent into the document, and submitting the SWPPP to OWNER for review and approval. In addition, payment shall include CONTRACTOR being fully responsible for implementing the SWPPP, including



implementing all required Best Management Practices (BMPs) identified in the SWPPP, performing and documenting all required inspections at the minimum frequency identified in the SWPPP, executing the delegation of authority form, maintaining the corrective action log, performing all required record keeping and training (including maintaining documentation of training), maintaining a log of any changes to the SWPPP, executing the Certification and Notification form at the completion of the project, executing Subcontractor Certification/Agreements, etc., and filing the Notice of Termination. Payment shall be made as follows:

- a. When 10% of the original contract amount is earned, 25% of the amount bid for implementation of the Storm Water Pollution Prevention Plan will be paid.
- b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for implementation of the Storm Water Pollution Prevention Plan will be paid.
- c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for implementation of the Storm Water Pollution Prevention Plan will be paid.
- d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for implementation of the Storm Water Pollution Prevention Plan will be paid.

**E. BID ITEM NO. 5 – “CONSTRUCT RMP “CUSTOMER TO INSTALL” OFFSITE AND ONSITE ELECTRICAL FACILITIES”**

1. **METHOD OF MEASUREMENT.** “Construct RMP “Customer to Install” Offsite and Onsite Electrical Facilities” will be measured based on percent of total Work in Bid Schedule completed and approved by RMP.
2. **BASIS OF PAYMENT.** “Construct RMP “Customer to Install” Offsite and Onsite Electrical Facilities” will be paid for when CONTRACTGOR completes and tests the offsite and onsite RMP electrical facilities, which are labeled in Sheet G-5 as “Customer to Install” facilities, which are in accordance with Rocky Mountain Power (RMP) Standards and requirements, Contract Drawings and Specifications, and are complete, inspected, tested and accepted by RMP. RMP facilities standards and requirements are found online. Work includes purchasing and installing the following RMP-approved materials: 1 switchgear vault, PVC conduits, sweeps, HDPE pipe (for HDD drilling under canal and pond), HDPE x PVC transition couplings; backfill materials; RMP approved installation work including HDD drilling per RMP approved Contractors and Standards, PVC conduit and sweeps installation, installing vault(s) trenching and backfilling, traffic control, testing all facilities, and other work per Drawings, Specifications and in accordance with RMP Standards and requirements until all is accepted by RMP.

**F. BID ITEM NO. 6 – “PAY FOR RMP TO COMPLETE OFFSITE AND ONSITE ELECTRICAL POWER SUPPLY”**

1. **METHOD OF MEASUREMENT.** “Pay for RMP to Complete Offsite and Onsite Electrical Power Supply” will be measured based on percent of total Work completed approved by RMP. Work will provide a complete, functional electrical power supply, including meter, for pump station (except for Work in Bid Item 5).
2. **BASIS OF PAYMENT.** Payment of lump sum bid amount in Bid Schedule to “Pay for RMP to Complete Offsite and Onsite Electrical Power Supply” will be as follows:
  - a. CONTRACTOR shall pay RMP 100% of this bid amount (in Bid Form) to

- construct (to start of RMP Work) the pump station power supply.
- b. OWNER will pay CONTRACTOR 95% of this amount when CONTRACTOR pays RMP the amount listed in the Bid form (i.e. for RMP to start their Work).
- c. OWNER will pay CONTRACTOR the last (retained) 5% of this amount when pump station power supply is tested, functional, complete, and approved by RMP and ENGINEER.

**G. BID ITEM NO. 7 – “REPLACE NATIVE SOILS UNDER PUMP STATION WITH STRUCTURAL FILL”**

Background. Geotechnical Report requires removal of native collapsible clay materials below pump station down to a suitable clay layer found in borings between 11- and 14-feet below existing grade. Actual suitable clay layer depth will be field verified by Geotechnical Engineer while Contractor is removing native overburden clays.

1. **GENERAL.** “Replace Native Soils Under Pump Station with Structural Fill”. Compact any native soils left onsite in compliance with specifications. Legally dispose of excess native soils offsite.
2. **METHOD OF MEASUREMENT.** “Replace Native Soils Under Pump Station with Structural Fill” measurement is based on percent of total Work in Bid Schedule (see paragraph 3 below) according to the following:
  - a. If Geotech Engineer field determines the suitable layer is above elevation 4598.0, there is no less compensation to Contractor.
  - b. If Geotech Engineer determines suitable clay layer is below elevation 4598.0, Contractor will be paid the lump sum bid amount plus a unit rate for additional cubic yards of structural fill required below elevation 4598.0, and structural fill below elevation 4598.0 will be compensated a unit rate 1.4 times the average \$/CY (assume 2000 cubic yards) of 1:1 sloping structural fill down to Elevation 4598.0. See plans.
  - c. Notes:
    - 1) Structural fill placed for CONTRACTOR convenience (i.e., above elevation 4610.3 line as shown in plans) is not measured or paid for.
    - 2) Native soils excavated and disposed of (offsite, or onsite per Sht C-1 grading plan) are not measured. They are paid for as part of 1:1 sloped structural fill.
3. **BASIS OF PAYMENT.** “Replace Native Soils Under Pump Station with 1:1 Sloped Structural Fill, includes removing Native Soils Under Pump Station projected from base of footings outward and away from pump station a 1:1 slope (or flatter) - down to EL 4598.0 and replacing removed soils in this prism with a 1:1 Sloped Structural Fill Supporting the Pump Station Footings and Floor – as shown in the Drawings. The Work in this bid item includes:
  - a. Remove native soils down to gravel layer. Assume for bid that gravel is at elevation 4598.0. Geotechnical Engineer will field verify actual gravel elevation.
  - b. Place and compact (to 95% or higher) 1:1 (or flatter) structural fill to support pump station footings and floor. Also backfill the rest of excavation outside of footings) with 95% compacted structural fill up to elev. 4610.3 as shown in plans.
  - c. Backfill and compact (with natives or imported materials) to over 95%, the rest of the excavation above elev 4610.3 (outside 1:1 structural fill supporting footings) up to surveyed subgrades for UBC (ie in paved areas around pump station).
  - d. Place and compact (with natives or imported materials) to over 90% the rest of the required onsite fills (located mainly east of pump station) up to surveyed subgrades for finished grade surface rock.

- e. Legally dispose of offsite ALL excess native earth.

CONTRACTOR will be paid at the Lump Sump Bid amount in Bid Form as follows:

- f. 25% will be paid when pump station structural fill support excavation is complete down to suitable clay layer, and approved by Geotechnical Engineer.
- g. Up to an additional 40%, for a total of 65%, will be paid when the 1:1 structural fill is complete and accepted up to elevation 4610.3 (before trenching for pipelines below pump station)
- h. The remaining 35% will be paid when the structural fill is complete (ie backfilled foundation) AND when ALL excavated earth is either:
  - 1) compacted onsite as backfill up to surveyed subgrade of UBC, or
  - 2) compacted onsite as fill up to surveyed subgrade of surface rock, or
  - 3) is legally disposed of offsite.
  - 4) Final 35% payment will NOT be made until ALL compacted fills meet compaction requirements. Geotech report states that native collapsible clays removed may not achieve 95% compaction if too wet, in which case special drying or imported materials may be required for backfilling under UBC) and final 35% payment will NOT be made until all excess earth above surveyed subgrades (of UBC and surface rock) is disposed of offsite.

#### H. BID ITEM NO. 8 – “16” RJ DIP WATER PIPELINE (ZONE 2)”

1. **METHOD OF MEASUREMENT.** Measurement of “16” RJ DIP Water Pipeline (Zone 2)” shall be according to the lineal foot of pipe acceptably installed as shown on the Contract Drawings and specified in the Specifications. Measurement shall be along the horizontal centerline of the acceptably installed pipe. Pipe in vertically or vertically diagonal directions will only be measured in the horizontal plane. Contractor shall include associated cost for any such pipe as the horizontal cost per foot. Measurement shall not include pipe paid elsewhere.
2. **BASIS OF PAYMENT.** Work completed under “16” RJ DIP Water Pipeline (Zone 2)” shall be paid for at the contract unit bid price per lineal foot listed in the bidder’s proposal and shall be considered complete compensation for all labor, equipment, and materials necessary, including but not limited to furnishing the ductile iron pipe, and fittings for a complete functional system. Work includes restrained joints (except from Sta 2+00 to 4+10, see plans), traffic control, excavation, dewatering, shoring; wax tape coating on all joints (buried flanges and mechanical joints), polyethylene wrapping pipe and fittings, installing safety tape and tracer wire; cathodic protection bonding of all joints (including to all valves, dismantling joints, fittings, etc), anodes and test stations per specs; a thrust block per City Det DW-2 on each new DIP elbow by connection to existing pipe, imported pipe zone and trench zone, backfilling and compacting, offsite disposal of excavated material, commissioning of pipeline (includes cleaning, flushing, disinfection, pressure testing, and a complete, pressurized, flowing connection to existing water pipelines, protection of buried utilities, and all other operations and materials and appurtenances required to complete this portion of the Work as herein described and as shown on the Contract Drawings. Payment shall also include furnishing, installing, and removing temporary air and blow-off valves and fittings required to flush, test and disinfect new pipelines.

#### I. BID ITEM NO. 9 – “24” RJ DIP WATER PIPELINES (ZONES 1 AND 2)”

1. **METHOD OF MEASUREMENT.** Measurement of “24” RJ DIP Water Pipelines

(Zones 1 & 2)" shall be according to the lineal foot of pipe acceptably installed as shown on the Contract Drawings and specified in the Specifications. Measurement shall be along the horizontal centerline of the acceptably installed pipe. Pipe in vertically or vertically diagonal directions will only be measured in the horizontal plane. Contractor shall include associated cost for any such pipe as the horizontal cost per foot. Measurement shall not include pipe paid elsewhere.

2. **BASIS OF PAYMENT.** Work completed under "24" RJ DIP Water Pipelines (Zones 1 & 2)" shall be paid for at the contract unit bid price per lineal foot listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, and materials necessary, including but not limited to furnishing the ductile iron pipe and fittings for a complete functional system. Work includes restrained joints (except from Sta 2+00 to 4+10, see plans), traffic control, excavation, dewatering, shoring; wax tape coating on all joints (buried flanges and mechanical joints), polyethylene wrapping pipe and fittings, installing safety tape and tracer wire; cathodic protection double bonding of all joints (including to all valves, dismantling joints, fittings, etc), anodes and test stations per specs; a thrust block per City Det DW-2 on each new DIP elbow by connection to existing pipe, DIP piping & valve for fire hydrant (including hydrant) and tee to Zone 1 surge tank, imported pipe zone and trench zone, backfilling and compacting, offsite disposal of excavated material, commissioning of pipeline (includes cleaning, flushing, disinfection, pressure testing, and a complete, pressurized, flowing connection to existing water pipelines), protection of buried utilities, and all other operations and materials and appurtenances required to complete this portion of the Work as herein described and as shown on the Contract Drawings. Payment shall also include furnishing, installing, and removing temporary air and blow-off valves and fittings required to flush, test and disinfect new pipelines.

**J. BID ITEM NO. 10 – "AIR VALVE VAULT ASSEMBLY"**

1. **METHOD OF MEASUREMENT.** "Air Valve Vault Assembly" shall be measured per each air valve vault assembly installed, including all Work shown and specified on Contract Drawings (ie Sheet C-12) and in Specifications.
2. **BASIS OF PAYMENT.** Payment for "Air Valve Vault Assembly" shall be made at the contract unit cost per each air valve vault assembly complete. Payment will be for all labor, materials, and equipment for furnishing and installing the vault, excavation, shoring, dewatering, compacted drain rock and backfill; manhole, ladder, vents, insulation, piping, fittings, assembly, earthwork, backfill, compaction, wax tape coating of DIP tee and polyethylene coating of DIP pipe; cleaning, disinfection, and leakage and operational testing of valves; and all related items and appurtenances.
  - a. 90% will be paid when the air valve assembly is installed complete.
  - b. The last 10% will be paid when all air valve assembly parts pass hydrostatic (all valves are drip tight) and disinfection tests and assembly is active on operational drinking water pipeline.

**K. BID ITEM NO. 11 – "18" RCP STORM DRAIN"**

1. **METHOD OF MEASUREMENT.** Measurement for "18" RCP Storm Drain" shall be according to the lineal foot of pipe acceptably installed as shown on the Contract Drawings and specified in the Specifications. Measurement shall be along the center line of the pipe between horizontal stationing distances of the installed and accepted

pipe. Pipe in vertically or vertically diagonal directions will only be measured in the horizontal plane.

2. **BASIS OF PAYMENT.** Work completed under 18" RCP Storm Drain" shall be paid for at the contract unit bid price per lineal foot listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, and materials, including but not limited to 18-inch diameter Reinforced Concrete Pipe (RCP) and RCP flared end section; potholing utilities; excavation, dewatering, shoring, installation, imported pipe zone and trench backfill material including granular borrow and untreated base course; removal and disposal of excavated material; coredrill and connection to existing 48" box; backfilling, compaction, removal and restoration of all surface improvements and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

**M. BID ITEM NO. 12 – "CURB INLET"**

1. **METHOD OF MEASUREMENT.** Measurement for "Curb Inlet" shall be measured per each curb inlet assembly installed, including all Work shown and specified on Contract Drawings and in Specifications.
2. **BASIS OF PAYMENT.** Payment for "Curb Inlet" shall be made at the contract unit cost per each curb inlet assembly complete. Payment shall be considered complete compensation for all labor, equipment, and materials, including but not limited to furnishing and installing precast concrete boxes, galvanized steel grating with support angles and removable fastener clips, connecting pipes to boxes, excavation, imported backfill, compaction, dewatering, removal and disposal of excess excavated material, cleaning, restoration of surface improvements, testing, and all other operations and materials required to complete a functioning drainage pipe system as herein described and as shown on the Contract Drawings.

**N. BID ITEM NO. 13 – "5' DIA MANHOLE"**

1. **METHOD OF MEASUREMENT.** Measurement for "5' Dia Manhole" shall be measured per each manhole assembly installed, including all Work shown and specified on Contract Drawings and in Specifications.
2. **BASIS OF PAYMENT.** Payment for "5' Dia Manhole" shall be made at the contract unit cost per each manhole assembly complete. Payment shall be considered complete compensation for all labor, equipment, and materials, including but not limited to furnishing and installing precast concrete eccentric 60" MH per City Std Det SS-2 on Sheet SS-1; connecting 4-inch drains with 1-way Tideflex valves to prevent backflow and ventilation into electrical and pump rooms; excavation, imported backfill, compaction, dewatering, removal and disposal of excess excavated material, cleaning, restoration of surface improvements, testing, and all other operations and materials required to complete a functioning drainage pipe system as herein described and as shown on the Contract Drawings.

**L. BID ITEM NO. 14 – "ORNAMENTAL METAL FENCE"**

1. **METHOD OF MEASUREMENT.** "Ornamental Metal Fence" shall be measured on a lineal foot basis for all new fencing as required on the Contract Drawings (Sheets C-1 & C-14) and Specifications.

2. **BASIS OF PAYMENT.** Payment for “Ornamental Metal Fence” shall be paid on a lineal foot basis for the completed work. Payment shall be considered full compensation including, but not limited to, all labor, material, and equipment for furnishing and installation of new 7-ft tall Ornamental Iron Fence, including concrete mow curb and a (one) 4-foot wide swing gate, including excavation, backfill, and compaction; steel reinforcement, concrete, grout, and mortar; ornamental iron fence, and all other appurtenances and other items required as shown on the Contract Drawings and Specifications.

**P. BID ITEM NO. 15 – “CANTILEVERED ROLLER SLIDE GATE”**

1. **METHOD OF MEASUREMENT.** “Cantilevered Roller Slide Gate” shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of the gate as noted, including all components required on the Contract Drawings (Sheet C-1, C-14, and electrical sheets) and in the Specifications.
2. **BASIS OF PAYMENT.** Payment for “Cantilevered Roller Slide Gate” shall be made at the contract lump sum bid price for the gate work as shown on the Contract Drawings and specified herein, made and certified by manufacturer of the ornamental iron fence. Payment shall include, but not be limited to all labor, materials, and equipment for furnishing and installing the 7-foot tall x 26-foot (min clear opening) roller type slide gate, electric slide gate operator, loop detectors, access control keypads and post, 3 remotes, SCADA ties and testing showing gate is monitored, opened and shut remotely through City SCADA system; electrical conduits and connections, conduits and instrumentation, excavations and backfilling; untreated base course, restoration of all surface improvements, startup, programming, and testing, and all other related items, complete, as detailed in Contract Drawings and Specifications.

**Q. BID ITEM NO. 16 – “PVC COATED CHAIN LINK FENCE AND GATE”**

1. **METHOD OF MEASUREMENT.** “PVC Coated Chain Link Fence and Gate” shall be measured on a lineal foot basis. Measurement shall be along the horizontal centerline of the acceptably installed fence. Fencing in vertically or vertically diagonal directions will only be measured in the horizontal plane. CONTRACTOR shall include associated cost for any such fencing as the horizontal cost per foot. See Sheets C-1 and C-15 and Specifications.
2. **BASIS OF PAYMENT.** Payment for “PVC Coated Chain Link Fence and Gate” shall be paid on a lineal foot basis for the completed work. Payment shall be considered full compensation including, but not limited to all labor, materials, and equipment for furnishing and installation of new 7’ tall Black PVC Coated Chain Link Fence and 16’ wide gate (two 8-ft swing panels) with lockable drop rod set in conc, no barb wire extension arms, post excavation, concrete, and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings and Specifications.

**R. BID ITEM NO. 17 – “CURB AND GUTTER”**

1. **METHOD OF MEASUREMENT.** “Curb and Gutter” shall be measured according to the lineal foot of curb and gutter acceptably installed as shown on the Contract Drawings (City Standard Detail ST-2B) and Specifications.
2. **BASIS OF PAYMENT.** Payment for “Curb and Gutter” shall be at the at the contract unit bid price per lineal foot of curb and gutter acceptably installed as shown in the

Drawings and Specifications. Payment shall be considered complete compensation for all work performed including staking, grading and compacting UBC subgrade, placing and finishing concrete, including all labor, equipment, material, UBC, concrete forms, finishing, and all other incidentals required complete the concrete curb and gutter work as herein described and as noted on the Drawings and Specifications.

**S. BID ITEM NO. 18 – “AC PAVING: 4” AC OVER 12” UBC”**

1. **METHOD OF MEASUREMENT** “AC Paving: 4” AC over 12” UBC” shall be measured by the Square Yard and shall include furnishing and installing 4” asphalt and 12” UBC (untreated base course or roadbase), including preparation of the surface and UBC for the asphalt pavement as shown on the Contract Drawings.
2. **BASIS OF PAYMENT** Payment for “AC Paving: 4” AC over 12” UBC” shall be considered full compensation for all work completed under this bid item and shall be paid for at the contract unit square yard price. Work shall include all labor, equipment, and materials, including but not limited to compacted finished subgrade, furnishing, and installing compacted 12-inches of UBC, compacted 4” of asphalt concrete, tack coat, and all other operations and materials required to complete the asphalt pavement as herein described and as shown on the Contract Drawings and meeting City of Saratoga Springs Standards.

**T. BID ITEM NO. 19 – “16’ WIDE CONC DRIVEWAY”**

1. **METHOD OF MEASUREMENT** “16’ Wide Conc Driveway” shall be measured according to the lineal foot of curb and gutter acceptably installed as shown on the Contract Drawings (City Standard Detail ST-4B) and in the Specifications.
2. **BASIS OF PAYMENT** Payment for “16’ Wide Conc Driveway” shall be at the at the contract unit bid price per each 16’ wide driveway acceptably installed as shown in the Drawings and Specifications. Payment shall be considered complete compensation for all work performed including staking, grading and compacting UBC subgrade, paving and finishing concrete, including all labor, equipment, material, concrete forms, finishing, and all other incidentals required complete the concrete curb and gutter work as herein described and as noted on the Drawings and Specifications

**U. BID ITEM NO. 20 – “1”-3” PELICAN PT ROCK SURFACING”**

1. **METHOD OF MEASUREMENT** This item shall not be measured.
2. **BASIS OF PAYMENT** Payment for “1”-3” Pelican Pt Rock Surfacing” shall be at the at the lump sum bid price in Bid Schedule. This rock is required on Sheet C-1 in unpaved areas between points 76, 77, 83, south to fence, 27, and back to 76. Payment shall be for all work including surveying, staking, grading and compacting subgrade, paving Dewitt Pro-5 Weed Barrier per manufacturer instruction, placing (without damaging weed barrier) 6” min thick of crushed surfacing per Spec Sections 31 11 00; 31 22 00; 31 23 23; and 32 11 33 and Sheet C-1 of Drawings.

**V. BID ITEM NO. 21 – “1”-2” SOUTH TOWN COBBLE ROCK SURFACING”**

1. **METHOD OF MEASUREMENT** This item shall not be measured.
2. **BASIS OF PAYMENT** Payment for “1”-2” South Town Cobble Rock Surfacing” shall be at the at the lump sum bid price in Bid Schedule. This rock is required on Sheet

C-1 in unpaved areas between points 29, 34, 25, 26, 76, 77, 83, south to fence, 28, and back to 29. Payment shall be for all work including surveying, staking, grading and compacting subgrade, pacing Dewitt Pro-5 Weed Barrier per manufacturer instruction, placing (without damaging weed barrier) 6" min thick of crushed surfacing per Spec Sections 31 11 00; 31 22 00; 31 23 23; and 32 11 33 and Sheet C-1 of Drawings Specifications.

**W. BID ITEM NO. 22 – “2”-4” SOUTH TOWN COBBLE ROCK SURFACING”**

1. **METHOD OF MEASUREMENT.** This item shall not be measured.
2. **BASIS OF PAYMENT.** Payment for “2”-4” South Town Cobble Rock Surfacing” shall be at the at the lump sum bid price in Bid Schedule. This rock is only required on Sheet C-1 in unpaved areas between points 1, 29, 34 and 25 and back to 1. Payment shall be for all work including surveying, staking, grading and compacting subgrade, pacing Dewitt Pro-5 Weed Barrier per manufacturer instruction, placing (without damaging weed barrier) 6” min thick of crushed surfacing per Spec Sections 31 11 00; 31 22 00; 31 23 23; and 32 11 33 and Sheet C-1 of Drawings.

**X. BID ITEM NO. 23 – “VERTICAL TURBINE PUMPS AND MOTORS”**

1. **METHOD OF MEASUREMENT.** “Vertical Turbine Pumps and Motors” shall not be measured but shall be for the single lump sum bid amount in the Bid Schedule.
2. **BASIS OF PAYMENT.** Payment for “Vertical Turbine Pumps and Motors” shall be paid be for the single lump sum bid amount in the Bid Schedule. Work shall include furnishing and installing five (5) 30” pump cans, each with a barrel isolation sheet (ie insulating flange), sleeves, and washers. The 2 cans without pumps shall have 36” square discharge head flanges with WSP risers with blind flanges (for installing future National HC16MC pump, or equal). 3 of the pump cans shall have pumps - each provided with a pump (National K12HC, or equal per spec), pump bowls, shafting and columns; 3 (100 hp) motors, 3 discharge heads; testing, startup, and all other pump related items not paid elsewhere as shown on the Contract Drawings and in the Specifications. Electrical gear and connections are paid elsewhere.

**Y. BID ITEM NO. 24 – “PUMP STATION PIPING SYSTEMS”**

1. **METHOD OF MEASUREMENT.** “Pump Station Piping Systems” shall not be measured but shall be paid for as a percent of the total work completed of the lump sum bid amount for completion of Pump House Piping work, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT.** Payment for “Pump Station Piping Systems” shall be made at the contract lump sum bid price for furnishing, installing, and testing the pump station piping system complete as per the Contract Drawings and Specifications. Payment shall include, but not be limited to, all labor, materials, and equipment for furnishing and installation of all items listed on pipe and valve schedule on Sheet C-5 including pipe, supports, valves, air valves, flow meters, fittings, concrete encasement, reinforcing, drain pipes, air gap drains, pressure gauges, fittings, copper, brass, bronze piping, PVC pipe and sleeves, hose bibbs, sampling nozzles, linings, coatings, insulating flanges, joint restraints. It includes, but is not limited to:



- a. 30" WSP (elbow + insulating flange) suction manifold w/ 18" FLG outlets
- b. 5 WSP buried suction pipes (part conc encased; coord. 22" or 24" w/ item 21) with RDCRS to (five) 18" buried gate valves and dismantling joints.
- c. 5 WSP discharge pipes: 12"x14" RDCR, 14" check valve, 14" BFM, elec actuator.
- d. 24" WSP discharge manifold w/ 14" FLG outlets
- e. 16"-14" Zone 2 piping, meters, valves, etc; both above and below (conc encased) grade. Piping ends at buried 16" horiz 45 deg elbow and at Zone 2 surge tank.
- f. 14" Zone 1 surge pipe (conc encased) from 14" gate valve to Zone 1 surge tank.
- g. 24" Zone 2 (South) piping, meter, valves, above and below (conc enc) grade ending at horiz 45 deg DIP elbow.
- h. cathodic protection double bonding of all buried joints (except insul FLGs).
- i. all drains and other piping, valving and piping equipment in and below pump house not addressed under other items

It includes disinfection and testing, and all other appurtenances and related items not paid elsewhere for a complete and operable pump station piping system.

## **Z. BID ITEM NO. 25 – "PUMP STATION STRUCTURE"**

1. **METHOD OF MEASUREMENT.** "Pump Station Structure" shall be paid for on a lump sum basis for construction of the pump station structure according to the amount defined in the Bid Schedule and as completed by CONTRACTOR.
2. **BASIS OF PAYMENT.** Payment for "Pump Station Structure" shall not be measured but shall be made at the contract lump sum bid price for completion of all items to construct the booster pump station structure as shown on the Contract Drawings and as specified herein. Payment shall include furnishing all labor, material and equipment including, but not limited to: reinforced concrete for pump cans and pump pedestals; reinforced concrete foundations and slabs (with, moisture proof underlay), sidewalks, reinforced unit masonry, roof trusses and sheathing, standing seam metal roofing, metal fascia and soffits, rainwater gutters and downspouts, snowguard (above all gutters), roof access cupolas for pumps and surge tanks, man doors, overhead coiling door with chain and electric operator, gypsum covered metal stud walls in electric room, insulation, gypsum acoustic ceilings, painting and coating, concrete equipment pads, pump pedestals; bollards; wall mounted fire extinguishers, fixed sound absorptive acoustical panels on pump room walls, and miscellaneous items to complete the structure of the pump station as shown on the Contract Drawings and specified herein.

## **AA. BID ITEM NO. 26 – "HVAC SYSTEM"**

1. **METHOD OF MEASUREMENT.** "HVAC System" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of HVAC systems as noted, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT.** Payment for "HVAC System" shall be made at the contract lump sum bid price for HVAC work as shown on the Contract Drawings and as specified herein. Payment shall include, but not be limited to all labor, materials, and equipment for furnishing, installing, and testing all HVAC equipment, including but not limited to, wire and conduit per Division 26, instrumentation, air handling units with exterior mounted condensing units, electric unit heaters, ductwork, exhaust fans, exhaust fan hoods, supports, louvers, and all other related items as shown on the Contract Drawings not paid elsewhere for a complete and operable HVAC system.

**BB. BID ITEM NO. 27 – “CONTROL PANELS, SCADA, PROGRAMMING, INTEGRATION”**

1. **METHOD OF MEASUREMENT.** “Control Panels, SCADA, Programming and Integration” shall not be measured but shall be paid for on a lump sum price for the complete design and fabrication of control panels, SCADA programming, and integration to be provided by APCO, Inc.
2. **BASIS OF PAYMENT.** Payment for “Control Panels, SCADA, Programming and Integration” shall be made at the contract lump sum price shown in the bid form for acceptable and complete control panels, SCADA programming and integration for the pump station controls as per the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment and materials including but not limited to, design and fabrication a control cabinet, creation of loop diagrams for the control system, termination of power, communication, and control wiring in the APCO-supplied control cabinet and at the instruments, mounting of telemetry equipment, programming of the PLCs, programming of the City HMI, for furnishing and installing a control system for the booster pump station and all other items as shown on the Contract Drawings required for a complete and operable SCADA and station control panel system; and commissioning control system so pumps flow will respond automatically to City SCADA signals indicating water level in Zone 2 Israel Tank; and all other operations and materials required to complete this portion of the work as herein described and as shown on the drawings. The APCO price quote for this bid item is included as the last 3 pages of this Measurement and Payment Spec Section.
3. **RELATED CONTRACTOR COSTS** - Payment does NOT include Contractor cost to coordinate work for this bid item, mount APCO supplied control cabinet, install control conduits, wiring, communication wiring, and furnish and install other instruments (flow meters, control valves, security switches, VFD’s, etc). Contractor costs to install and coordinate Work in Bid Item 22 shall be put in Bid Item 23.

**CC. BID ITEM NO. 28 – “ELECTRICAL AND CONTROL SYSTEMS”  
(EXCEPT FOR WORK IN ITEMS: 5, 6, 16, 24, 27, 28, 30, 31)**

1. **METHOD OF MEASUREMENT.** “Electrical and Control Systems” shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of electrical work, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT.** Payment for “Electrical and Control Systems” shall be made at the contract unit lump sum bid price for completion of all electrical work as shown on the Contract Drawings and Specifications. Payment shall include, but not be limited to, all labor, materials, and equipment for furnishing and installing all electrical and controls equipment on the project including within and without the pump station, pump room, and electrical room, three (3) variable frequency drives, panelboards, transformers, control panels, electrical enclosures, lighting, service outlets, pressure switches, pressure transducers, intrusion switches, flood switches, buried conduits, electrical service connection and equipment, lightning protection system, connecting to: offsite power supply (Bid Items 5 & 6), pump motors (Bid Item 24), HVAC (Bid Item 27), SCADA (Bid item 28), (Bid Item 30), Bid Item (31) and all other items as shown on the Contract Drawings required for a complete and operable electrical system. Payment shall also include all buried or above grade conduits required for Bid Additive Alternate A2.

**DD. BID ITEM NO. 29 – “SURGE TANKS SYSTEM”**

1. **METHOD OF MEASUREMENT.** “Surge Tanks System” shall not be measured, but paid for on a lump sum basis for the construction of the Surge Tanks System and accompanying facilities, including all of work complete as shown and specified in Contract Drawings and Specifications.
2. **BASIS OF PAYMENT.** Payment for “Surge Tanks System” shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, tools, and materials to complete the Surge Tanks System, including but not limited to all labor, materials, and equipment for furnishing and installing Zone 1 and Zone 2 bladder type surge tanks, appurtenances, and all water piping, valves, couplings, fittings, pressure monitoring devices, pressure relief valves; conduits, supports, and all other related items and appurtenances for a complete bladder type surge tank system; including cleaning, air and water filling, calibration, disinfection, and testing of tanks and all instruments in accordance with Manufacturer recommendations, complete, and as shown in Contract Drawings and Specifications.

**EE. BID ITEM NO. 30 – “BACKUP ELECTRICAL GENERATOR SYSTEM”**

1. **METHOD OF MEASUREMENT.** “Backup Electrical Generator System” shall not be measured but shall be paid for at the lump sum bid item amount for the construction of a complete functional Backup Electrical Generator System that automatically starts up and runs all pumps and pump station when power from power grid fails, as required in Contract Drawings and Specifications.
2. **BASIS OF PAYMENT.** Payment for the “Backup Electrical Generator System” shall be made at the contract lump sum bid price. Payment shall include, but not be limited to all labor, materials, and equipment for furnishing and installing a sound attenuated 400kW generator on skid with 24-hour (min) diesel fuel tank, generator paralleling equipment, automatic transfer switch, stainless steel epoxy anchor bolts, reinforced concrete pads and mounting generator to such pads, buried conduits and wiring, connections, testing, and all other related items as shown on the Contract Drawings not paid elsewhere for a complete and operable backup emergency generator system.

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION (Not Used)**

- END OF SECTION –

THE FOLLOWING 3 PAGES ARE APCO PRICE QUOTE TO PERFORM  
**BID ITEM 28. CONTROL PANELS, SCADA, PROGRAMMING, INTEGRATION**

# BOOSTER 8 CP-1 AND CP-2

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## Proposal for SARATOGA SPRINGS

Prepared for  
1/20/2023

Sterling Reese  
SARATOGA SPRINGS

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# Project Description

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## SUMMARY & SCOPE

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APCO is pleased to provide the following proposal for supply of CP-1 and CP-2 at the new Booster 8 site. CP-1 will provide controls to the 3 pumps anticipated with this phase of the project, with capacity for 2 pumps to be added in the future, according to project plans. CP-2 is a relay panel that will provide over and under pressure protection to the pumps.

This scope does not provide for any labor, instrumentation, or hardware beyond what is required to fabricate the two control panels already described. SCADA programming is also not included in this scope.

### LABOR

- Panel drawings
- Hardware procurement
- Panel fabrication
- Testing
- Delivery to site

### HARDWARE

- CP-1 Main Control Panel (using the Saratoga Springs Large Standard Design)
- CP-2 Relay Panel

# Assumptions

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- No software licensing is included as part of this scope.
  - PLC and HMI programming are anticipated to be provided under a separate scope of work.
  - No instrumentation will be provided as part of this project.
  - Installation of the provided panels is assumed to be provided by others.

## Budget



This project will be carried out on a Fixed Fee basis and this proposal has been prepared in accordance with this billing structure. The project will be billed on a percent complete basis until the fulfilment of the listed price. Equipment procurement is a part of the project and will be billed upon receipt by APCO.

Sales tax will be charged if a Utah state sales tax exemption certificate is not provided or already on file.

CP-1 Main Control Panel	\$ 45,477
CP-2 Relay Panel	\$ 12,695
<b>Total</b>	<b>\$ 58,172</b>

## Conclusion

We look forward to working with you on this and future projects. Please contact me if you have any questions.

Sincerely,

Cameron Price  
(801) 989-1168  
cameron.price@apco-inc.com





**SECTION 01 30 00**  
**ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.1 COORDINATION AND PROJECT CONDITIONS**

- A. Coordinate scheduling, Submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.
- C. After OWNER occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of OWNER's activities.
- D. OWNER, UDOT, land owners, and/or utility owners may be working within the project area while this contract is in progress. If so, CONTRACTOR shall schedule his work in conjunction with these other organizations to minimize mutual interference.
- E. All existing City waterlines and service connections shall remain active during construction except during connections to new water mains are required. All connections to the existing waterlines, except those being hot-tapped, shall only be done upon successful completion of mainline installation and testing.
- F. Water service to this area can be interrupted to that CONTRACTOR shall connect up new 24- and 16-inch pipelines. Included in Construction Schedule forecasted connection dates for these water lines. Schedule with City final connection dates and times. A copy of CONTRACTOR'S notification letter shall be reviewed and approved by OWNER prior to distribution.
- G. If required to work in Foothill Blvd, or any other City Street or Utah Department of Transportation (UDOT) right-of-way, CONTRACTOR shall notify UDOT 72 hours prior to work being performed therein. Work within the City Streets or UDOT right-of-way shall be in accordance with their required permit and their license agreement with OWNER. CONTRACTOR shall obtain and comply with all required permits.
- H. Coordination with Adjacent Property Owner
  - 1. Once each week, CONTRACTOR shall hand deliver or mail a written "**Construction Status Update Notice**" to all residents, businesses, schools and property owners adjacent to and affected by the Work. Notice shall be on CONTRACTOR's company letterhead paper and be secured to doorknob should occupants not be home. Obtain ENGINEER's review of notice prior to distribution. As a minimum the notice shall contain the following:
    - a. name and phone number of CONTRACTOR's representative for the project
    - b. work anticipated for the next 7 days including work locations and work by subcontractors and utility companies
    - c. rough estimate of construction schedule through end of project

- d. anticipated driveway approach closures
  - e. anticipated water, sewer or power outages
  - f. anticipated vehicular traffic impacts, rerouting or lane closures
  - g. anticipated pedestrian impacts and sidewalk closures
  - h. changes to public transportation bus routes
  - i. any other construction or work items which will impact or restrict the normal use of streets and amenities
2. Failure to comply with this contract provision is considered grounds for project suspension per Article 16.01 of the General Conditions (EJCDC 00 70 00).

## **1.2 FIELD ENGINEERING**

- A. ENGINEER shall provide the following construction staking at no cost to CONTRACTOR.
- 1. Benchmark network throughout the construction zone
  - 2. Pipeline alignment stakes at approximately 100-foot intervals and all bends and designated changes in grade.
  - 3. Stake locations for air valve vaults, air vents and other fittings
- B. Construction staking and surveying shall be performed by a registered Land Surveyor in the State of Utah.
- C. CONTRACTOR shall provide all other survey construction staking as necessary to complete the required work according to the contract documents.
- D. ENGINEER shall not be responsible for stakes, etc. removed through negligence of CONTRACTOR and in that event shall be compensated by CONTRACTOR for re-staking efforts.
- E. Locate and protect survey control and reference points. Promptly notify ENGINEER of discrepancies discovered.
- F. Control datum for survey is that shown on Contract Drawings.
- G. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- H. Promptly report to ENGINEER loss or destruction of reference point or relocation required because of changes in grades or other reasons.
- I. Coordinate with all property owners to determine the location of existing sewer and water service laterals.
- J. All service laterals shall be verified and indicated on the Record Drawings supplied by CONTRACTOR to ENGINEER.

## **1.3 PRECONSTRUCTION MEETING**

- A. Prior to the commencement of work at the site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by CONTRACTOR's

Project Manager, its superintendent, and its subcontractors as appropriate. Other attendees will be:

1. ENGINEER and the Resident Project Representative (RPR)
  2. Representatives of OWNER
  3. Governmental representatives as appropriate
  4. Others as requested by CONTRACTOR, OWNER, or ENGINEER.
- B. Unless previously submitted to ENGINEER, CONTRACTOR shall bring to the conference one copy of each of the following:
1. Progress schedule
  2. Procurement schedule of major equipment and materials and items requiring long lead time
  3. Shop Drawings/Sample/Substitute or "Or Equal" submittal schedule.
- C. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda may include the following:
1. CONTRACTOR's tentative schedules
  2. Transmittal, review, and distribution of CONTRACTOR's submittals
  3. Processing applications for payment
  4. Maintaining record documents
  5. Critical work sequencing
  6. Field decisions and Change Orders
  7. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs
  8. Major equipment deliveries and priorities
  9. CONTRACTOR's assignments for safety and first aid
- D. ENGINEER will preside at the preconstruction conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.
- E. CONTRACTOR should plan on the conference taking no less than 6 hours.

#### **1.4 PROGRESS MEETINGS**

- A. CONTRACTOR shall schedule and hold regular on-site progress meetings at least weekly and at other times as required by ENGINEER or as required by progress of the work. CONTRACTOR, ENGINEER, and all subcontractors active on the site shall be represented at each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers', and other subcontractors.
- B. ENGINEER shall preside at the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.
- C. At each construction progress meeting a progress report shall be presented by CONTRACTOR containing an updated Progress Schedule. Where the delayed completion date of a project phase is noted, CONTRACTOR shall describe the

anticipated delays or problems and outline the action plan being taken to resolve the issues.

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION (Not Used)**

- END OF SECTION –

**SECTION 01 32 16**  
**CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Comply with City of Saratoga Springs Standards regarding progress schedules and the following. If there is disagreement, the more restrictive requirements apply.
- B. CONTRACTOR shall prepare a schedule of the WORK in accordance with the Contract Documents that will allow ENGINEER and/or OWNER to determine if the WORK can be substantially complete within the Contract Time.
- C. CONTRACTOR shall develop the project construction schedule using a computer software program using the Critical Path Method (CPM) for scheduling. The program shall be **Primavera Project Planner (P6)**, or approved equal.

**1.2 RELATED WORK**

- A. Related work in other sections includes but is not limited to:
  - 1. 01 30 00 Administrative Requirements
  - 2. 01 33 00 Submittal Procedures

**1.3 DEFINITIONS**

- A. **Activity.** A discrete, identifiable task or event that takes time, uses resources, has a definable start and stop date, furthers the work's progress, and can be used to plan, schedule, and monitor a project.
- B. **Activity ID.** A unique, alphanumeric, identification code assigned to an activity.
- C. **Bar Chart.** Also called a Gantt chart, a graphic representation of a schedule without relationships. A timescale appears along the horizontal axis.
- D. **Completion Date, Contract.** The original date specified in the contract for completion of the project or a revised date resulting from authorized time extensions. The contract may also specify completion dates for interim milestones, phases, or other portions of the project.
- E. **Completion Date, Scheduled.** The completion date projected or forecasted by the schedule. The schedule may also project or forecast interim completion dates for milestones, phases, or other portions of the project.
- F. **Constraints.** A restriction imposed on the start or finish dates of an activity that modifies or overrides the activity's logic relationships.
- G. **Critical Path.** The **Longest Path**.
- H. **Data Date.** The first day in the Initial or Baseline Schedule and the first day for performance of the work remaining in the Monthly Schedule Update. (May also be defined as the date from which a schedule is calculated.)

- I. **Float, Total.** The amount of time an activity can be delayed and not delay the project completion date.
- J. **Holidays.** Holidays observed are:
1. 1st day in January (New Year's Day)
  2. 3rd Monday in January (Martin Luther King, Jr. Day)
  3. 3rd Monday in February (Presidents' Day)
  4. Last Monday in May (Memorial Day)
  5. 4th day in July (Independence Day)
  6. 24<sup>th</sup> day in July (Pioneer Day)
  7. 1st Monday in September (Labor Day)
  8. 11th day in November (Veterans Day)
  9. 4th Thursday in November (Thanksgiving Day)
  10. 25th day in December (Christmas Day)
  11. For holidays that fall on a Saturday, both the Saturday and the preceding Friday are considered to be holidays. For holidays that fall on a Sunday, both the Sunday and the following Monday are considered to be holidays.
- K. **Longest Path.** The sequence of activities that establishes the scheduled completion date.
- L. **Open End.** The condition that exists when an activity has either no predecessor or no successor, or when an activity's only predecessor relationship is a finish-to-finish relationship or only successor relationship is a start-to-start relationship.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. **General Requirements** - Plan and schedule the project and report progress to the owner. Provide a schedule using the critical path method (CPM). The owner's acceptance of any schedule, whether initial, baseline, or update, does not modify the contract or constitute endorsement or validation by OWNER of the contractor's logic, activity durations, or assumptions in creating the schedule. By accepting the schedule, OWNER does not guaranty that the project can be performed or completed as scheduled. If CONTRACTOR or OWNER discovers errors after the schedule has been accepted, correct the error in the next schedule submission.
- B. **Title Block:** Show on each page the following items:
1. Project Title, Contract Number, and CONTRACTOR's name
  2. Date of Submittal, revision number, page number, and Project status cutoff date
  3. Approval signatures for each subcontractor
  4. Legend of Symbols, codes, and abbreviations
  5. Network nomenclature, e.g., "Detailed" or "Summary" or "Building Area" identification
- C. **Required Schedules**
1. **Initial Schedule** - OWNER will use the initial schedule to monitor progress until the baseline schedule is accepted. Prepare and submit a schedule for the first 60 calendar days of work plus a summary bar chart schedule for the balance of the project. Activity durations on the summary chart may exceed 15 working days.

- a. At least 10 calendar days before the preconstruction meeting, submit the initial schedule to the owner. Ensure that the schedule shows milestone and completion dates no later than the specified contract milestone and completion dates.
  - b. OWNER will review the initial schedule at the preconstruction meeting. At this meeting, be prepared to generally discuss the proposed schedule for the entire project, not just the 60-day period covered by the initial schedule. If deviations to the staging, phasing, or sequencing required by the contract documents are proposed, be prepared to discuss these deviations.
  - c. Within 5 calendar days of the preconstruction meeting, OWNER will respond by accepting the initial schedule, rejecting the schedule and identifying the reason for rejection, or by asking for more information. Address the reasons for rejection or provide the information requested and resubmit the revised initial schedule no more than 5 calendar days after OWNER's response. OWNER may withhold progress payments until CONTRACTOR submits the initial schedule.
2. **Baseline Schedule** - No more than 30 calendar days after approval of the initial schedule, prepare and submit a baseline schedule to OWNER for review. Within 10 calendar days of receipt of the baseline schedule, OWNER will respond by accepting the baseline schedule, rejecting the schedule and identifying the reason for rejection, or by asking for more information. Address the reasons for rejection or provide the information requested and resubmit the revised baseline schedule no more than 10 calendar days after OWNER's response. OWNER may withhold progress payments until the contractor submits and OWNER accepts the baseline schedule.
3. **Monthly Schedule Update** - Prepare and submit a monthly schedule update to OWNER that depicts the status of the project as of the end of the month. The update will reflect a new data date, work performed up to, but not including, the new data date, and the plan for completing the project. Submit the schedule update by the first Monday of the following month. OWNER may withhold progress payments until the contractor submits and the owner accepts the schedule update.
4. **Final Schedule** - Within 30 calendar days of final acceptance of the project, submit a final schedule with actual start and finish dates for each activity. Include with the submission a certification signed by the principal of the firm stating:
  - a. "To the best of my knowledge, the enclosed final schedule reflects the actual start and finish dates of the activities contained herein."

## 1.5 SCHEDULE REQUIREMENTS

- A. Provide a schedule that meets the following requirements:
  1. Calculate the schedule using the Retained Logic scheduling option unless written authorization is obtained from OWNER to use the Progress Override scheduling option.
  2. Do not use the following types of logic relationships:
    - a. Negative lags
    - b. Lags in excess of 10 workdays
    - c. Start-to-Finish relationships

- d. Open Ends (Only the first activity will have no predecessor and only the last activity will have no successor)
- e. Constraints (CONTRACTOR may use a limited number of constraints only with OWNER's written authorization)
- f. Manually modified dates (CONTRACTOR may manually modify dates only with OWNER's written authorization)
- g. Obtain OWNER's authorization prior to using lags with finish-to-start relationships
- 3. Includes the following work activities, as applicable:
  - a. Work to be performed by CONTRACTOR, subcontractors, and suppliers.
  - b. Work to be performed by OWNER, other contractors, and third parties such as government agencies and authorities, permitting authorities, or other entities required for completion of the project.
  - c. The project start date, scheduled completion date, and other contractually mandated milestones, start or finish dates for phases, or site access or availability dates.
  - d. Submittal, review, and approval activities when applicable, including time periods for OWNER's approval as specified in the contract documents.
  - e. Fabrication, delivery, installation, testing, and similar activities for materials, plants, and equipment
  - f. Sampling and testing periods
  - g. Settlement and surcharge periods
  - h. Cure periods
  - i. Utility notification and relocation
  - j. Installation, erection and removal, and similar activities related to temporary systems or structures such as temporary electrical systems or shoring.
  - k. Punch list, substantial completion, final cleanup, and similar activities.
  - l. Required acceptance testing, inspections, or similar activities.
  - m. Duration for receipt of permits or acquisition of rights-of-way.
- 4. Define the following attributes for each activity in the schedule:
  - a. A unique alphanumeric Activity ID.
  - b. A unique descriptive name, using such attributes as work type and location to distinguish activities.
  - c. A duration stated in workdays of no more than 15 workdays, unless a longer duration is requested by CONTRACTOR and approved by OWNER.

## **1.6 SCHEDULE SUBMISSION REQUIREMENTS**

- A. For each schedule submission, submit the following items:
  - 1. A Transmittal Letter
  - 2. A narrative report
  - 3. A Primavera Version 6.0 compatible electronic file of the schedule on a CD, DVD, or thumb-drive
  - 4. The critical path in bar chart format (Longest Path sort)
  - 5. Work paths with total float values within 20 workdays of the critical path's total float value in bar chart format. For example, if the critical path has a total float value of zero, then show all of the work paths with total float values of 20 or less.
  - 6. An activity network diagram plotted in color, on E-size paper, with each sheet of the plot including a title, match data for diagram correlation, a page number, and a legend. The activity network diagram should only be submitted with schedules with revised relationships or activity durations.



7. A Predecessor/Successor report with the following items for each activity:
  - a. Activity ID and description
  - b. Original duration
  - c. Remaining duration
  - d. Calendar ID
  - e. Predecessors and Successors
  - f. Early start date
  - g. Early finish date
  - h. Late start date
  - i. Late finish date
  - j. Total float
  - k. Relationship type
  - l. Lags
  - m. Constraints
- B. Narrative Reports for the Initial and Baseline Schedule – For each submission of the initial and baseline schedule provide a narrative report that includes the following information:
  1. Explanation of the overall plan to complete the project, including where the work will begin and the how the work and crews will flow through the project.
  2. Use and application of the workdays per week, number of shifts per day, number of hours per shift, holidays observed, and how the schedule accommodates adverse weather days for each month or activity.
  3. If the project is a multi-year project, then identify the work to be completed in each construction season
  4. A statement explaining why the schedule completion date is forecast to occur before or after the contract completion date
  5. An explanation stating why any of the contract milestone dates are forecast to occur late
  6. A description of problems or issues anticipated.
  7. A description of anticipated delays, including:
    - a. Identification of the delayed activity by activity ID and description
    - b. Type of delay
    - c. Cause of the delay
    - d. Effect of the delay on other activities, milestones, and completion dates
    - e. Identification of the actions needed to avoid or mitigate the delay
  8. A description of the critical path
  9. A description of work paths with total float values within 20 workdays of the critical path's total float value. For example, if the critical path has a total float value of zero, then describe all of the work paths with total float values of 20 or less.
  10. A statement identifying constraints and an explanation of the reason for and purpose of each constraint
  11. A statement describing the status of required permits
  12. The statement describing the reason for the use of each lag
- C. Narrative Reports for the Monthly Schedule Update and Revised Schedule – For each submission of the monthly schedule update and revised schedule provide a narrative report that includes the following information:

1. A description of the status of the scheduled completion date (and any contract milestone date(s)) since the last schedule submitted
2. A statement explaining why the scheduled completion date is forecast to occur before or after the contract completion date. An explanation stating why any of the contract milestone dates are forecasted to occur late
3. A description of the work performed since the last schedule update.
4. A description of unusual labor, shift, equipment, or material conditions or restrictions encountered or anticipated.
5. A description of the problems encountered or anticipated since the last schedule submission.
6. A statement that identifies and describes any current and anticipated delays. A discussion of delays in the narrative report does not constitute notice and does not replace the need for CONTRACTOR to provide notice as required by the contract. Include the following:
  - a. Identification of the delayed activity by activity ID and description
  - b. Type of delay
  - c. Cause of the delay
  - d. Effect of the delay on other activities, milestones, and completion dates
  - e. Identification of the actions needed to avoid or mitigate the delay.
7. A description of the critical path
8. A description of changes in the critical path and schedule completion date (for the project or its milestones) from the last schedule submission
9. Descriptions of the status of work paths that have total float values within 20 workdays of the critical path identified in the previous schedule submission.
10. Descriptions of work paths with total float values within 20 workdays of the critical path's total float value. For example, if the critical path has a total float value of negative 25, then show all of the near critical paths with total float values of negative 5 or less.
11. A statement or Claim Digger report that identifies the changes made between the previous schedule submission and the current proposed schedule, including, but not limited to:
  - a. Data date
  - b. Completion date
  - c. Activity code assignments
  - d. Scheduling options
  - e. Activity descriptions
  - f. Added activities
  - g. Deleted activities
  - h. Added activity relationships
  - i. Deleted activity relationships
  - j. Activity original durations
  - k. Activity remaining durations
  - l. Activity actual start and finishes
  - m. Percent complete
  - n. Constraints
  - o. Activity resources
  - p. Activity costs
  - q. Activity coding
12. A statement providing status of pending items, including, but not limited to:
  - a. Permits
  - b. Change orders

- c. Time extension requests
- d. Noncompliance or similar notices indicating deficiencies in CONTRACTOR's performance

## **1.7 FLOAT TIME**

- A. Neither OWNER nor CONTRACTOR owns the float time. The Project owns the float time. Liability for the delay to the project complete date rests with the party causing the delay.

## **1.8 CHANGE ORDERS**

- A. Upon approval of a Change Order or upon receipt by CONTRACTOR of authorization to proceed with additional work, the change shall be reflected in the next Monthly Schedule update. Contractor shall utilize a sub-network in the schedule depicting the changed work and its effect on other activities. This sub-network shall be tied to the main network with appropriate logic so that a true analysis of the critical path can be made. In order to receive an extension in Contract Times and change in price for time extension, CONTRACTOR must submit the sub-network analysis.

## **1.9 INCLEMENT WEATHER PROVISIONS**

- A. CONTRACTOR's schedule shall include at least the number of days of delay due to unusually severe weather as required by the Supplementary General Conditions.

## **1.10 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for construction progress scheduling. Full compensation for construction progress scheduling shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which it relates.

## **PART 2 PRODUCTS (Not Used)**

## **PART 3 EXECUTION (Not Used)**

- END OF SECTION -

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**SECTION 01 33 00**  
**SUBMITTAL PROCEDURES**

**PART 1 GENERAL**

**1.1 SUBMITTAL PROCEDURES**

A. General

1. Comply with City of Saratoga Springs Standards for submittals (ie Section 01300 Administrative Procedures (Submittal)) and the following specification (01 33 00). If there is disagreement between City Standards and the following, the more stringent requirements shall apply.
  2. This Section outlines the general terms that CONTRACTOR must follow for preparing and providing Submittals to ENGINEER for review.
  3. CONTRACTOR shall anticipate resubmitting Submittals for major equipment or complex systems.
  4. If CONTRACTOR has questions about submittal requirements, CONTRACTOR is encouraged to communicate with ENGINEER to discuss requirements prior to submitting the Submittal.
  5. Substitutions shall be clearly identified on the Submittal transmittal form and shall include all the information required per Section 01 60 00 – Product Requirements.
- B. Wherever Submittals are required by the Contract Documents, transmit 5 copies of each Submittal or a single electronic PDF file to ENGINEER with a Submittal transmittal form which is acceptable to ENGINEER.
- C. Sequentially number transmittal forms. Mark revised Submittals with original number and sequential alphabetic suffix, i.e., Submittal 1, Submittal 1.A, etc.
- D. Identify Project, Contractor, subcontractor and/or supplier; pertinent drawing and detail number, and Specification section number, appropriate to Submittal.
- E. Each Submittal shall contain material pertaining to no more than one equipment or material item.
- F. Each Submittal shall have the Specification section and applicable paragraph number clearly identified on the front of the Submittal transmittal form. A copy of the Specification section and applicable paragraph shall be included with the Submittal and items included shall be clearly mark as either in compliance or not in compliance. For items not in compliance a description shall be provided explaining the reason for non-compliance.
- G. CONTRACTOR shall review Submittals prior to submission to ENGINEER. Apply Contractor's stamp, signed and dated, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents. Identify any deviations from the Contract Documents on the Submittal transmittal form.
- H. Schedule Submittals to expedite Project, and deliver to ENGINEER at their business address. Coordinate submission of related items.

- I. Submittals shall be submitted sufficiently in advance to allow ENGINEER not less than ten regular working days for examining the drawings. These drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items and unit assemblies in relation to the contract drawings and/or specifications.
- J. Identify variations from Contract Documents and product or system limitations which may adversely affect successful performance of completed Work.
- K. If a Submittal is returned to CONTRACTOR marked "APPROVED", or similar notification, formal revision and resubmission will not be required.
- L. If a Submittal is returned marked "APPROVED – MAKE CORRECTIONS NOTED", or similar notification, CONTRACTOR shall make the corrections on the Submittal, however, formal revision and resubmission will not be required.
- M. Resubmittals
  - 1. If a Submittal is returned marked "AMEND AND RESUBMIT", or similar notification, CONTRACTOR shall revise the Submittal and resubmit the required number of copies.
  - 2. Identify changes made since the previous submission.
- N. Rejected Submittals
  - 1. If a Submittal is returned marked "REJECTED – RESUBMIT", or similar notification, it shall mean either that the proposed material or product does not satisfy the specification, the Submittal is so incomplete that it cannot be reviewed, or is a substitution request not submitted in accordance with Section 01 60 00 – Product Requirements.
  - 2. CONTRACTOR shall prepare a new Submittal or submit a substitution request according to Section 01 60 00 – Product Requirements and shall submit the required number of copies.
- O. Distribute copies of reviewed Submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- P. Submittals not requested will not be recognized or processed.
- Q. Unless noted otherwise, corrections indicated on Submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the contract requirements.
- R. Fabrication or purchase of an item may only commence after ENGINEER has reviewed the pertinent Submittals and returned copies to CONTRACTOR marked either "APPROVED" or "APPROVED – MAKE CORRECTIONS NOTED".
- S. ENGINEER's review of CONTRACTOR Submittals shall not relieve CONTRACTOR of the entire responsibility for the corrections of details and dimensions. CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR Submittals. CONTRACTOR shall be responsible for dimensions and

quantities, coordinating with all trades, the design of adequate connections and details, and satisfactory and safe performance of the work.

## **1.2 CONSTRUCTION PROGRESS SCHEDULES**

- A. Submit initial schedules within 15 days after date of Owner-Contractor Agreement. After review comments on the initial schedule are received from ENGINEER and OWNER, CONTRACTOR shall resubmit required revised data within ten days.
- B. Submit revised Progress Schedules with each Application for Payment.
- C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
- D. Submit computer generated horizontal bar chart with separate line for each major portion of Work or operation, identifying first work day of each week.
- E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.
- F. Indicate estimated percentage of completion for each item of Work at each submission.
- G. Submit separate schedule of submittal dates for shop drawings, product data, and samples.

## **1.3 PRODUCT DATA**

- A. Product Data: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 78 50 - Project Closeout.

## **1.4 SHOP DRAWINGS**

- A. Shop Drawings: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Fabrication of an item may be commenced only after ENGINEER has reviewed the pertinent submittals and returned copies to CONTRACTOR marked either "APPROVED", or "APPROVED - MAKE CORRECTIONS NOTED". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

- C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
  - 1. Include signed and sealed calculations to support design.
  - 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
  - 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 78 50 - Project Closeout.

## **1.5 SAMPLES**

- A. Whenever indicated in the Specifications or requested by ENGINEER, CONTRACTOR shall submit at least 1 sample of each item or material to ENGINEER for acceptance at no additional cost to OWNER.
- B. Samples, as required herein, shall be submitted for acceptance prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delay in the Work.
- C. Unless otherwise specified, all colors and textures of specified items will be selected by ENGINEER from the manufacturer's standard colors and standard materials, products, or equipment lines.

## **1.6 CERTIFICATES**

- A. When specified in individual Specification sections, submit certification by manufacturer, installation/application subcontractor, or CONTRACTOR to ENGINEER, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to ENGINEER.

## **1.7 MANUFACTURER'S INSTRUCTIONS**

- A. When specified in individual Specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to ENGINEER for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.



## **1.8 MANUFACTURER'S FIELD REPORTS**

- A. When required in individual sections, have Manufacturer or Supplier provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable and to make written report of observations and recommendations to ENGINEER.

## **1.9 OPERATIONS AND MAINTENANCE MANUAL SUBMITTAL**

- A. See Section 01 78 00 Operations and Maintenance Manuals.

## **PART 2 PRODUCTS (Not Used)**

## **PART 3 EXECUTION (Not Used)**

- END OF SECTION –

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**SECTION 01 42 13**  
**ABBREVIATIONS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.
- B. See Sheet G-3 for abbreviations use on the Contract Drawings.
- C. Abbreviations and acronyms not included in below list are per ASME Y14.38.

**1.2 ABBREVIATIONS AND ACRONYMS**

AASHTO	American Association of the State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association (formerly AFBMA)
ACI	American Concrete Institute
AGA	American Gas Association
AGC	American General Contractors
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASOC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
AWPB	American Wood Preservers Bureau
BBC	Basic Building Code, Building Officials and Code Administrators International
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
CWI	Certified Welding Inspector
DIPRA	Ductile Iron Pipe Research Association
DWQ	Department of Water Quality
DWR	Drinking Water Regulations

ECTC	Erosion Control Technology Council
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
ETC	Electrical Test Laboratories
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FM	Factory Mutual System
HI	Hydraulic Institute
IBC	International Building Code
ICBO	International Conference of Building Officials
ICC	International Code Council
ICC-ES	International Code Council Evaluation Service
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IFC	International Fire Code
IMC	International Mechanical Code
IPC	International Plumbing Code
ISA	Instrument Society of America
ISO	International Organization of Standardization
ITE	Institute of Traffic Engineers
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturer's Association
MSS	Manufacturers Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NISO	National Information Standards Organization
NSF	NSF International (formerly National Sanitation Foundation)
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PVC	Polyvinyl Chloride Pipe
RMA	Rubber Manufacturers Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SSPC	Society for Protective Coating (formerly Steel Structure Painting Council)
SSPWC	Standard Specification for Public Works Construction
TPI	Truss Plate Institute
UDOT	Utah Department of Transportation
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCRSI	Western Concrete Reinforcing Steel Institute
WI	Woodwork Institute
WRI	Wire Reinforcements Institute, Inc.
WSP	Welded Steel Pipe
WWPA	Western Wood Products Association

**PART 2      PRODUCTS (Not Used)**

**PART 3      EXECUTION (Not Used)**

- END OF SECTION –

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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 GENERAL**

**1.1 QUALITY ASSURANCE**

- A. TITLES OF SECTIONS AND PARAGRAPHS. Captions accompanying Specifications sections and paragraphs are for convenience of reference only, and do not form a part of the Specification.
- B. APPLICABLE PUBLICATIONS. Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards or requirements of the respective issuing agencies which have been published as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the drawings shall be waived because of any provision of, or omission from, said standards or requirements.
- C. SPECIALISTS, ASSIGNMENTS. In certain instances, specifications test requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements and shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the work; also, they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with CONTRACTOR.

**1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS**

- A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.
- B. Reference herein to "Building Code" or "Uniform Building Code" shall mean the International Building Code of the International Code Council. The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.
- C. In case of conflict between codes, reference standards, drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of ENGINEER for clarification and directions prior to ordering or providing any materials or labor. CONTRACTOR shall bid the most stringent requirements.
- D. APPLICABLE STANDARD SPECIFICATIONS. CONTRACTOR shall construct the Work specified herein in accordance with the requirements of the Contract Documents

and the referenced portions of those referenced codes, standards, and Specifications listed herein; except, that wherever references to "Standard Specifications" are made, the provisions therein for measurement and payment shall not apply.

- E. References in the Contract Documents to "Standard Specifications" shall mean the Contract Documents including all current supplements, addenda, and revisions thereof.
- F. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- G. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including changes and amendments thereto.
- H. UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY. Wells, tanks, pumping stations and culinary water pipelines shall conform to the requirements of Utah Administrative Code Rule R 309. Water and sewer pipeline installation shall conform to the requirements of Utah Administrative Code Rule R 317-3-2.9 "Protection of Water Supplies" for horizontal and vertical separation.
- I. UTAH DEPARTMENT OF TRANSPORTATION (UDOT) REQUIREMENTS. CONTRACTOR's work on UDOT property or right-of-way shall conform to UDOT's latest edition of Standard Specifications For Road and Bridge Construction.
- J. U.S. ARMY CORPS OF ENGINEERS (COE) REQUIREMENTS. CONTRACTOR's work shall conform to COE Specifications in accordance with Section 404 of the Clean Water Act for excavation in wetlands.
- K. Reference herein to APWA shall mean the latest edition of the "Manual of Standard Specifications" and "Manual of Standard Plans" as prepared by the American Public Works Association and the Associated General Contractors of America.
- L. All provisions of the Manual of Standard Specifications, Latest Edition and Manual of Standard Plans, Latest Edition both published by the Utah Chapter of the American Public Works Association are hereby made a part of the Contract Documents by reference. The publications may be purchased separately from the Utah Technology Transfer Center, Utah State University, 4111 Old Main Hill, Logan, UT 84322-4111. Any conflicts, between the technical specifications, drawings, and other provisions or documents contained in the Contract Form or Contract Documents versus provisions contained in the Manual of Standard Specifications, Latest Edition and Manual of Standard Plans, Latest Edition published by the Utah Chapter of the American Public Works Association, shall be resolved in favor of the technical specifications, drawing, and provisions contained in the Contract form or Contract Documents.

## **PART 2 PRODUCTS (Not Used)**

## **PART 3 EXECUTION (Not Used)**

- END OF SECTION -



**SECTION 01 45 00**  
**QUALITY CONTROL AND MATERIALS TESTING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section outlines responsibilities for controlling quality of materials, products and workmanship.

**1.2 MATERIALS**

- A. All materials incorporated in the project shall be new and shall fully comply with the Specifications. Unless otherwise clearly provided in the Specifications, all workmanship, equipment, materials, and articles incorporated in the Work covered by the Contract are to be of the best available grade of their respective kinds. Whenever, in the specifications, any material, article, device, product, fixture, form, type of construction, or process indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired and shall be deemed to be followed by the words "or approved equal" and CONTRACTOR may in such case, upon receiving ENGINEER's approval, purchase and use any item, type, or process which shall be substantially equal in every respect to that indicated or specified.
- B. Materials and equipment may be used in the Work based upon receipt of a Supplier's certificate of compliance. Certificate must be in possession of CONTRACTOR and reviewed by ENGINEER prior to use.
- C. Quality Assurance Testing by OWNER and/or ENGINEER shall not relieve CONTRACTOR of responsibility to furnish materials and work in full compliance with Contract Documents.

**1.3 MANUFACTURER'S INSTRUCTIONS**

- A. Should instructions conflict with Contract Documents, request clarification before proceeding.
- B. When required in individual sections, submit manufacturer's instructions in the quantity required for product data, delivery, handling, storage, assembly, installation, start-up, adjusting, balancing, and finishing, as appropriate.

**1.4 WORKMANSHIP**

- A. Maintain performance control and supervision over Subcontractors, Suppliers, manufacturers, products, services, workmanship, and site conditions, to produce work in accordance with Contract Documents.

- B. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- C. Provide suitable qualified personnel to produce specified quality.
- D. Ensure finishes match approved samples.

#### **1.5 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

#### **1.6 TESTING AND INSPECTION SERVICES**

- A. Testing agency and testing for quality control and material testing shall be furnished by CONTRACTOR as part of the project. Results of testing shall be reported to CONTRACTOR and ENGINEER on site. Reports of the testing shall be transmitted directly to ENGINEER.
- B. City also desires to do supplemental testing. Coordinate with City to accommodate their supplemental testing. See Section 01 14 00.
- C. Materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the work by the testing agency. CONTRACTOR shall give ENGINEER written notification well in advance of actual readiness of materials to be tested and/or inspected at point of origin so ENGINEER may witness testing by the testing agency. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude retesting or reinspection at the site of the work.
- D. CONTRACTOR shall furnish such samples of materials as are requested by the ENGINEER, without charge. No material shall be used until reports from the testing agency have been reviewed and accepted by ENGINEER. See Section 01 33 00 - Submittal Procedures.

## **1.7 UNSATISFACTORY CONDITIONS**

- A. Examine areas and conditions under which materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

## **1.8 AUTHORITY AND DUTIES OF PROJECT REPRESENTATIVE**

- A. Refer to Section 00 73 00 "Supplementary Conditions" sub-section SC 10.03 "Resident Project Representative".

## **1.9 QUALITY CONTROL TESTING**

- A. ENGINEER's failure to detect any defective Work or materials does not prevent later rejection when such defect is discovered nor does it obligate ENGINEER for acceptance.
- B. CONTRACTOR shall provide 24-hours minimum notice to ENGINEER for all testing required by these specifications so ENGINEER may coordinate or be present during testing.

## **1.10 TESTING ACCEPTANCE AND FREQUENCY**

- A. Minimum Quality Control Testing Frequency: As defined in Table 01 45 00-1, CONTRACTOR shall be responsible to ensure that all testing is performed at the frequencies shown. CONTRACTOR shall uncover any work at no cost to OWNER to allow the testing agency to perform required testing at the frequency shown.
- B. Acceptance of Defective Work: As defined in Article 14.04 of the General Conditions.

## **PART 2 PRODUCTS (Not Used)**

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

### **3.2 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

**TABLE 01 45 00-1: QUALITY CONTROL TESTING FREQUENCY**

<b>SYSTEM or MATERIAL</b>	<b>TESTS</b>	<b>MINIMUM REQUIRED FREQUENCY</b>
<b>SUBGRADE AND BACKFILL MATERIALS</b>		
Section 31 23 15 Excavation and Backfill for Buried Pipelines	Field Density	1 test per 200 linear feet per 1.5 feet of backfill thickness placed.
	Laboratory	1 test for each material type which includes proctor, classification, and gradation.
Section 31 23 23 Excavation and Backfill for Structures	Field Density	1 test per 2000 square feet per 1.5 feet of backfill thickness placed within 20 feet of pump station building. At least one test per 1.5 feet of backfill thickness under pump station.
	Laboratory	1 test for each material type which includes proctor, classification, and gradation.
Section 32 11 23 Road Base - Untreated Base Course	Field Density	<u>Base course subgrade</u> : 1 test per 2,000 square feet of area. <u>Base course</u> : 1 test per 2,000 square feet of area.
	Laboratory	<u>Base course</u> : 1 test for each material type which includes proctor, classification, and gradation.
<b>ASPHALT</b>		
Section 32 12 16 Hot-Mix Asphalt Concrete Paving	Mix Design	<u>Marshall Test Method</u> : 1 test initially per each type of material and each change in target, and for each day of production thereafter. <u>Specific Gravity</u> : 1 per each Marshall Test <u>Extraction</u> : 1 test per each Marshall Test
	Field Density	<u>Bituminous surfaces</u> : 1 test per 2,000 square feet placed or part thereof.
	Asphalt Thickness and Core Density	<u>Bituminous surfaces</u> : 1 test sample every 300 linear feet of completed roadway.
<b>PORTLAND CEMENT CONCRETE</b>		
Section 3 30 00 Cast-in-Place	Slump	1 test every day of placement (if less than 100 cubic yards in a day), 1 test for every 100 cubic yards, or 1 test for each 3,000 square feet of surface area for slabs and more frequently if batching appears inconsistent.

SYSTEM or MATERIAL	TESTS	MINIMUM REQUIRED FREQUENCY
Concrete	Entrained air	1 test with slump test.
	Ambient and concrete temperatures	1 test with slump test.
	Water cement ratio.	to be verified and provided with batch tickets.
	Compressive strength	1 set of 5 cylinders. 1 test every day of placement (if less than 100 cubic yards in a day), 1 test for every 100 cubic yards, or 1 test for each 3,000 square feet of surface area for slabs, and more frequently if batching appears inconsistent.
NOTES:		
1 Additional tests shall be conducted when variations occur due to the contractor's operations, weather conditions, site conditions, etc. 2 Classification, moisture content, Atterberg limits and specific gravity tests shall be conducted for each compaction test if applicable. 3 Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates. 4 Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement calculations.		

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## **SECTION 01 45 23**

### **TESTING AGENCY SERVICES**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. CONTRACTOR shall be responsible for providing Construction Quality Control Testing of all soils, concrete, etc. as required by the various sections of these Specifications. This section includes the following:
  - 1. Use of independent testing agency
  - 2. Control testing report submittal requirements
  - 3. Responsibilities of testing agency

##### **1.2 RELATED WORK**

- A. Related work specified in other sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 01 22 00 Measurement and Payment

##### **1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM D 3740 Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
  - 2. ASTM D 4561 Standard Practice for Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials
  - 3. ASTM E 329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

##### **1.4 DEFINITIONS**

- A. Independent Testing Agency: A testing agency NOT owned by CONTRACTOR, and an agency that does not have any preferential affiliation or association with CONTRACTOR, or any of CONTRACTOR's Subcontractors and Suppliers other than entering into a contract with CONTRACTOR to perform the duties defined in these Specifications.
- B. Professional Engineer: An engineer who complies with Utah licensing law and is acceptable to the authority having jurisdiction.

## **1.5 QUALITY ASSURANCE**

- A. CONTRACTOR shall employ and pay for services of an independent testing agency which complies with ASTM D 3740, ASTM D 4561, and ASTM E 329 to test materials for contract compliance.

## **1.6 CONTRACTOR SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures
- B. If CONTRACTOR is employing and paying for an independent testing agency, prior to start of Work, submit testing agency's name, address, telephone number and the following:
  - 1. Concrete Technician: Approved by ENGINEER or ACI certified.
  - 2. Person charged with engineering managerial responsibility
  - 3. Professional engineer on staff to review services
  - 4. Level of certification of technicians

## **1.7 TESTING AGENCY SUBMITTALS**

- A. Field Test Report: Submit report no later than the end of the current day.
- B. Laboratory Test Report: Submit original report within 48 hours after test results are determined.
- C. Final Summary Report: Submit prior to final payment
- D. On all reports include:
  - 1. Project title, number and date of the report
  - 2. Date, time and location of test
  - 3. Name and address of material Supplier
  - 4. Identification of product being tested and type of test performed
  - 5. Identify whether test is initial test or retest
  - 6. Results of testing and interpretation of results
  - 7. Name of technician who performed the testing

## **1.8 RESPONSIBILITIES OF TESTING AGENCY**

- A. Calibrate testing equipment at least annually with devices with an accuracy traceable to either National Bureau of Standards or acceptable values of natural physical constraints.
- B. Provide sufficient personnel at site and cooperate with CONTRACTOR, ENGINEER and OWNER's Representative in performance of testing service.
- C. Secure samples using procedures specified in the applicable testing code.
- D. Perform testing of products in accordance with applicable sections of the Contract Documents.
- E. Immediately report any compliance or noncompliance of materials and mixes to CONTRACTOR, ENGINEER, and OWNER's Representative.



- F. When an out-of-tolerance condition exists, perform additional inspections and testing until the specified tolerance is attained, and identify retesting on test reports.

#### **1.9 LIMITS ON TESTING AGENCY AUTHORITY**

- A. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Agency may not suspend Work.
- C. Agency has no authority to accept Work for OWNER.

#### **1.10 MEASUREMENT AND PAYMENT**

- A. Testing agency services shall be measured or paid as provided in Section 01 22 00-Measurement and Payment.

#### **PART 2 PRODUCTS (Not Used)**

#### **PART 3 EXECUTION (Not Used)**

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**SECTION 01 50 00**  
**TEMPORARY CONSTRUCTION UTILITIES AND ENVIRONMENTAL CONTROLS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Comply with City of Saratoga Springs Standards and the following. If there is disagreement the more stringent requirements shall apply.
- B. This section covers temporary utilities, including electricity, lighting, telephone service, water, and sanitary facilities; temporary controls, including barriers, protection of work, and water control; and construction facilities, including parking, progress cleaning, and temporary buildings.

**1.2 TEMPORARY UTILITIES**

- A. Temporary Electricity: CONTRACTOR shall provide, maintain, and pay for all power required by CONTRACTOR, including electrical service to CONTRACTORS field office.
- B. Temporary Lighting: CONTRACTOR shall provide all temporary lighting required for execution of his work and for employee and public safety. As a minimum, lighting levels during working hours shall meet the requirements of OSHA Subsection 1926.56 illumination.
- C. Temporary Heating and Cooling
  - 1. Provide heating and cooling devices as needed to maintain specified conditions for construction operations.
- D. Temporary Ventilation
  - 1. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Telephone Service: CONTRACTOR shall provide, maintain and pay for telephone service to the field office at time of project mobilization.
- F. Temporary Water Service
  - 1. CONTRACTOR shall provide for all his workers on the project, adequate and reasonably convenient uncontaminated drinking water supply. All facilities shall comply with the regulations of the local and State Departments of Health.
  - 2. CONTRACTOR shall be responsible to arrange for water, both potable and non-potable water.
  - 3. When water is taken from a city water system or any other potable water supply source for construction purposes, suitable precautions shall be taken to prevent cross connections and contamination of water supply.
- G. Temporary Sanitary Facilities: CONTRACTOR shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and State Departments of Health.

TEMPORARY CONSTRUCTION UTILITIES  
AND ENVIRONMENTAL CONTROLS

### 1.3 TEMPORARY CONTROLS

- A. Barriers: Provide barriers as necessary to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
- B. Project Security
  - 1. CONTRACTOR shall make all necessary provisions to protect the project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.
  - 2. Entry Control:
    - a. Restrict entrance of persons and vehicles into Project site.
    - b. Allow entrance only to authorized persons.
- C. Dust Control: Execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.
- D. Pest Control: Provide methods, means, and facilities to prevent rodents, pests and insects from damaging the Work.
- E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. All chemicals used during construction or furnished for project operation whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instruction of the manufacturer.
- F. Protection of Work: CONTRACTOR shall protect installed work and provide special protection where specified in individual specifications sections. CONTRACTOR shall provide temporary and removable protection for installed products, and shall control activity in immediate work area to minimize damage.
- G. Open Burning: No open burning of waste materials will be allowed.
- H. Explosives and Blasting: The use of explosives on the work will not be permitted.
- I. Noise Abatement: In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.
- J. STORM AND GROUND WATER
  - 1. CONTRACTOR shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work, whether the water be from surface or underground water sources.

2. In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water into private property or into streets or drainage ways inadequate for the increased flow.
3. CONTRACTOR shall maintain effective means to minimize the quantity of sediments leaving the work area either by storm water or CONTRACTOR's own dewatering operations. CONTRACTOR shall be responsible for obtaining required permits and complying with all City, State, and Federal storm water management regulations and requirements, including preparing and implementing a Storm Water Pollution Prevention Plan (SWPPP) for Construction Activities. If required, CONTRACTOR shall submit a copy of the Notice of Intent and the SWPPP to the OWNER for review and approval.

## **1.4 CONSTRUCTION FACILITIES**

### **A. VEHICULAR ACCESS**

1. Construct temporary access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
2. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.
3. Location of temporary access roads and detours shall be approved by ENGINEER.
4. Provide unimpeded access for emergency vehicles.
5. Provide and maintain access to fire hydrants and control valves free of obstructions.
6. Provide means of removing mud from vehicle wheels before entering streets.
7. When possible, use existing on-site roads for construction traffic.

### **B. Parking: CONTRACTOR shall provide temporary parking areas to accommodate use of construction personnel. Parking shall be located in an area approved by ENGINEER.**

### **C. Progress Cleaning**

1. CONTRACTOR shall maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition. Upon completion of work, repair all damage caused by equipment and leave the project site free of rubbish or excess materials of any kind.
2. Thoroughly clean all spilled dirt, gravel, or other foreign materials caused by the construction operations from all streets and roads at the conclusion of each day's operation.
3. It shall be the responsibility of CONTRACTOR to promptly clean up and remove any oil and/or fuel spills caused by CONTRACTOR or his Sub-contractors during the course of the project. Contaminated soil shall be properly disposed of by CONTRACTOR in accordance with all applicable laws. CONTRACTOR shall be responsible for any damages to OWNER resulting from CONTRACTOR's negligence in promptly cleaning up said spills.

## **1.5 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

### **A. Prior to Final Application for Payment, CONTRACTOR shall remove temporary above grade or buried utilities, equipment, facilities, and materials; clean and repair damage**

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caused by installation or use of temporary work; and restore existing facilities used during construction to original condition.

## 1.6 CULTURAL RESOURCES

- A. CONTRACTOR's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archeological, or cultural resources (hereinafter called "cultural resources").
- B. CONTRACTOR shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.
- C. If a suspected or unsuspected historical, archaeological, or paleontological item, feature, or site or other cultural resource is encountered during subsurface excavations at the site of construction, the following procedures shall be instituted:
  - 1. Construction operations shall be immediately stopped in the vicinity of the discovery and ENGINEER and OWNER shall be notified of the nature and exact location of the finding. CONTRACTOR shall not damage the discovered objects and shall provide written confirmation of the discovery to ENGINEER within two (2) calendar days.
  - 2. OWNER and ENGINEER will then immediately notify the State Historical Preservation Office (SHPO) and the Utah Geological Survey (UGS).
  - 3. SHPO and UGS will investigate the finding and determine if the resource requires protection and the disposition of the said resource.
- D. If SHPO and UGS determine that the potential find is a bona fide cultural resource, CONTRACTOR shall suspend work at the location of the find under the provisions for changes contained in Articles 11, 12, and 13 of the General Conditions, Section 00 70 00 – General Conditions.

## PART 2 PRODUCTS

### 2.1 TEMPORARY EROSION CONTROL MATERIALS

#### A. EROSION CONTROL BLANKETS

- 1. Erosion control blankets shall meet the requirements of the Erosion Control Technology Council (ECTC) and the FHWA Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03 Section 713.17 as a Type 3.B Extended Term Double Net Erosion Control Blanket. The erosion control blanket shall be fabricated from UV-stabilized polypropylene and a straw/coconut blend. The blanket shall be **Model SC150 by Tensar North American Green, Excel CS-3 by Western Excelsior**, or approved equal. The functional longevity shall be 24 months minimum.

#### B. SILT FENCE

- 1. Use woven fabric meeting the following properties.

<b>Table 1 - Silt Fence Geotextile</b>			
<b>Property</b>	<b>ASTM</b>	<b>MARV's</b>	
		<b>Standard</b>	<b>High Performance</b>
Grab Tensile Strength, lbs.	D 4632	90 <sup>(a)</sup>	120 <sup>(a)</sup>
Grab Elongation, %	D 4632	< 40	< 40
Flux, gal/min/ft <sup>2</sup>	D 4491	15	90
Apparent Opening Size, (AOS-US sieve)	D 4751	> 20	> 30
Ultraviolet Degradation, %	D 4355	70	90
<b>NOTES</b> (a) Percent of tensile strength retained determined after weathering per ASTM D 4355 for 500-hours			

2. High performance fence to have tape yarns in one principle direction only.
3. Add stabilizers or inhibitors to make the filaments resistant to sunlight or heat deterioration.
4. Finish edges to prevent outer yarn from pulling away from the fabric.
5. Sheets of fabric may be sewn or bonded together. Provide minimum width recommended by manufacturer.
6. No deviation from any requirement in Table 2 due to the presence of seams.
7. Manufactured with pockets for posts, hems with cord, or with posts pre-attached using staples or button head nails.

#### C. POSTS

1. Minimum length: 4-feet.
2. Steel: Round, U shaped, T shaped, or C shaped with a minimum weight of 1.3-pounds per foot, and have projections for fastening wire.
3. Wood as follows:
  - a. Soft wood posts at least 3-inches in diameter, or nominal 2 x 4-inches and straight to provide a fence without noticeable misalignment.
  - b. Hard wood post providing a minimum cross-sectional area of 2.25 square-inches.
4. Fasteners for Wooden Posts:
  - a. Wire staples No. 17 gage minimum with a crown at least 3/4-inches wide and legs at least 1/2-inch long.
  - b. Nails 14 gage minimum, 1-inch long with 3/4-inch button.

## **PART 3 EXECUTION**

### **3.1 SILT FENCE**

- A. Beginning work means acceptance of existing conditions.
- B. Maintain the silt fence until revegetation is complete (defined as when cover reaches a density of at least 70% of pre-disturbance levels).
- C. Clear area of any debris and obstructions that may damage geotextile.
- D. Place post in all low points.
- E. Install posts a maximum of 8-feet apart with at least 18-inches in the ground. If not possible to achieve depth, secure posts to prevent overturning.
- F. Attach filter fabric by wire, cord, pockets, staples, nails, or other effective means.
  - 1. When using a wire support fence, provide at least 6 horizontal wires with a minimum of 12 gage wire. Space vertical wires 6-inches maximum. Secure geotextile to the up slope side of the post. Extend wire into the trench a minimum of 2-inches and extend a maximum of 36-inches above the ground surface.
- G. Install fabric so 6 to 8-inches of fabric remain at the bottom to be buried. Splice together only at support posts with at least a minimum overlap of 18-inches. Extend buried portion 6-inches deep and the rest upstream of the fabric fence.
- H. Sediment Removal: Remove sediment before deposit reaches 1/2 of the height of the silt fence or raise the height of silt fence. After removal of sediment, dress landscape.
- I. Schedule of Locations: Typical locations include the toe of fill slopes, the downhill side of fill slopes, the downhill side of large cut areas, and at natural drainage areas. Limit geotextile materials to handle an area equivalent to 1,000 square feet per 10-feet of fence. Use caution should site slope be steeper than 1:1 (horizontal:vertical), and water flow rates exceed 1 cubic foot per second per 10-feet of fence face.

- END OF SECTION -



**SECTION 01 50 30**  
**PROTECTION OF EXISTING FACILITIES**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Comply with City of Saratoga Springs Standards and the following. If there is disagreement, the more stringent requirements shall apply.
- B. Any existing facilities, disturbed which are located in or adjacent to the line of work such as curbs, gutters, drive approaches, sidewalks, driveways, fences, underground pipes, conduits, or utilities, shall be cleaned up and restored in kind by CONTRACTOR and in accordance with the Specifications contained herein governing the various types of services involved.
- C. CONTRACTOR shall not perform work that would affect any oil, gas, sewer, or water pipeline; any telephone, fiber optic, television cable, or electric transmission line; any fence; or any structure, until authorization has been obtained from owner of the improvement. Provide owner of the improvement due notice of the beginning of the work, and remove, shore, support, or otherwise protect such improvement or replace the same.

**1.2 RELATED WORK**

- A. Related work specified in other sections includes, but is not limited to:

Section 01 78 50 Project Closeout

**1.3 RESTORATION OF FENCES**

- A. Where it is necessary to remove any fence to facilitate CONTRACTOR's operation, CONTRACTOR shall obtain prior agreement with owner of the fence for removal of the fence and shall be responsible for any damage due to negligence of CONTRACTOR. As soon as practical, the fence shall be restored substantially to the same or improved condition as it was prior to the commencement of the work. Where livestock is present CONTRACTOR shall provide temporary fencing to keep livestock away from the construction area.

**1.4 UNDERGROUND SERVICE ALERT**

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, CONTRACTOR shall notify the regional notification center (Blue Stakes of Utah) at 1-800-662-4111 or 811 or submit an on-line request at [www.bluestakes.org](http://www.bluestakes.org) at least 2 days, but no more than 7 days, prior to such excavation.

**1.5 INTERFERING STRUCTURES AND UTILITIES**

- A. CONTRACTOR shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. Prior to submittal of

Shop Drawings, and prior to commencing any excavations for new pipelines or structures, conduct investigations, including exploratory excavations and borings, to determine the location and type of underground utilities and services connections that could result in damage to such utilities. It shall be the responsibility of CONTRACTOR to locate and expose all existing underground and overhead structures and utilities in such a manner as to prevent damage to same. CONTRACTOR shall notify all utility offices concerned at least 48 hours in advance of construction operations in which a utility agency's facilities may be involved. This shall include, but not be limited to, irrigation water, culinary water, telephone, television cables, fiber optic communication, gas, and electric. CONTRACTOR shall be responsible for any and all changes to, reconnections to public utility facilities encountered or interrupted during prosecution of the work, and all costs relating hereto shall be at CONTRACTOR's expense. CONTRACTOR shall contract with and pay Public Utility Agencies for work required in connection with all utility interferences and handle all necessary notifications, scheduling, coordination, and details. The cost of public utility interferences shall be included in CONTRACTOR's lump sum or unit price bid covering the major contract facility to which interference or changes are attributable.

- B. All exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of the construction to avoid possible delays to CONTRACTOR's progress. Prepare a report identifying each utility by its size, elevation, station and material of construction. Immediately notify ENGINEER and the utility in writing as to any utility discovered in a different position than as marked in the field or shown on the Drawings, or any utility which is not marked in the field or not shown on the Drawings.
- C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility. Conform to local agency requirements for backfill and pavement repair subsequent to performing exploratory excavations.
- D. Any damages to private property, either inside or outside the limits of the easements provided by OWNER, shall be the responsibility of CONTRACTOR. Any roads, structures, or utilities damaged by the work shall be repaired or replaced in a condition equal to or better than the condition prior to the damage. Such repair or replacement shall be accomplished at CONTRACTOR's expense without additional compensation from OWNER.
- E. CONTRACTOR shall remove and replace small miscellaneous structures such as fences and culverts which are damaged by the construction activity at his own expense without additional compensation from OWNER. CONTRACTOR shall replace these structures in a condition as good as or better than their original condition.
- F. At points where CONTRACTOR's operations are adjacent to or across properties of railway, telegraph, telephone, irrigation canal, power, gas, water, or adjacent to other property (damage to which might result in considerable expense, loss, and inconvenience), no work shall be started until all arrangements necessary for the protection thereof have been made.
- G. The locations of the major existing culinary water lines, gas pipes, underground electric, cable television, and telephone lines that are shown on the plans were taken from city maps, and maps supplied by the utility owner. No excavations were made to verify the

locations shown for underground utilities, unless specifically stated on the Drawings. It should be expected that some location discrepancies will occur. Neither OWNER nor its officers or agents shall be responsible for damages to CONTRACTOR as a result of the locations of the utilities being other than those shown on the plans or for the existence of utilities not shown on the plans.

- H. CONTRACTOR shall be solely and directly responsible to owners and operators of such properties for any damage, injury, expense, loss or inconvenience, delay, suits, actions, or claims of any character brought because of an injury or damage which may result from the carrying out of the work to be done under the contract.
- I. All utilities including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities encountered along the line of the work shall remain continuously in service during all operations under the Contract, unless other arrangements satisfactory to ENGINEER are made with owner of said utility.
- J. In the event of interruption to either domestic or irrigation water, or to other utility services as a result of accidental breakage, or as a result of being exposed or unsupported, CONTRACTOR shall promptly notify the proper authority. CONTRACTOR shall cooperate with the authority in restoration of service as soon as possible, and shall not allow interruption of any water or utility service outside working hours unless prior approval is received.
- K. In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of CONTRACTOR, be notified by OWNER to move such property within a specified reasonable time. When utility lines that are to be moved are encountered within the area of operations, CONTRACTOR shall notify ENGINEER a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.
- L. Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing Utility or other improvement which is indicated, CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such Utility or improvement in a manner satisfactory to ENGINEER and OWNER of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by CONTRACTOR in a manner that will restore or replace the Utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

## **1.6 RIGHTS-OF-WAY**

- A. CONTRACTOR shall be required to confine construction operations within the dedicated rights-of-way for public thorough fares, or within areas for which construction easements have been obtained, unless they have made special arrangements with the affected property owners in advance. CONTRACTOR shall be required to protect stored materials, cultivated trees and crops, and other items adjacent to the proposed construction site.
- B. CONTRACTOR shall submit for approval by ENGINEER the type and size of equipment used, and the methods for work performed on the rights-of-way across private

properties, to avoid or minimize injury to trees, shrubs, gardens, lawns, fences, driveways, retaining walls, or other improvements within the rights-of-way.

- C. The construction easement widths and access to private properties are as shown on the Drawings and as described in the easement documents; however CONTRACTOR is to minimize impacts to surface improvements within the right-of-way. CONTRACTOR shall obtain a signed release from the property owner, approving restoration of work in the construction easements across or bordering private properties. See Project Closeout Section 01 78 50, 1.4.D.
- D. Property owners affected by the construction shall be notified by CONTRACTOR at least 48 hours in advance of the time the construction begins. During all construction operations, CONTRACTOR shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to his property for a period exceeding 8 hours unless CONTRACTOR has made special arrangements with the affected persons. CONTRACTOR shall, daily or more frequently if necessary, grade all disturbed areas to be smooth for motor vehicle traffic.

#### **1.7 PROTECTION OF SURVEY, STREET OR ROADWAY MARKERS**

- A. CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Survey markers or points disturbed by CONTRACTOR shall be accurately restored after street or roadway resurfacing has been completed.

#### **1.8 TREES OR SHRUBS WITHIN PROJECT LIMITS**

- A. Except where trees or shrubs are indicated to be removed, CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER. Existing trees and shrubs which are damaged during construction shall be trimmed or replaced by CONTRACTOR or a certified tree company under permit from the jurisdictional agency and/or OWNER. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.
  - 1. Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosenes, coal tar, creosote, or other material injurious to the life of the tree.
  - 2. CONTRACTOR shall immediately notify the jurisdictional agency and/or OWNER if any tree or shrub is damaged by CONTRACTOR's operations. If, in the opinion of said agency or OWNER, the damage is such that replacement is necessary, CONTRACTOR shall replace the tree or shrub at its own expense. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a smaller size, CONTRACTOR shall pay to OWNER of said tree a compensatory payment acceptable to the tree or shrub owner, subject to the approval of the jurisdictional

agency or OWNER. The size of the tree or shrub shall be not less than 1-inch diameter nor less than 6 feet in height.

## **1.9 RESTORATION OF PAVEMENT**

- A. Pavement work shall meet the specifications for installation as noted in APWA Section 33 12 16.
- B. All paved areas damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Pavements which are subject to partial removal shall be neatly sawcut in straight lines.
- C. Wherever required by the local agency having jurisdiction, CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

## **1.10 CONCRETE WORK**

- A. Concrete work shall meet the specifications for installation as noted in APWA Section 32 16 13 Driveway, Sidewalk, Curb and Gutter.
- B. All flat work in streets tying into existing flatwork shall be doweled into the existing concrete. Dowels to be spaced at 12" O.C. and be No. 5 rebar x 14" for slabs up to 8 inches in thickness and No. 8 rebar x 18" for slabs over 8 inches.

## **1.11 LAWNS**

- A. Lawns that are damaged or destroyed during performance of the work shall be repaired or replaced with turf sod according to APWA Section 32 92 00 - Turf and Grass.

## **1.12 FENCES**

- A. Fences that are damaged or destroyed during performance of the work shall be repaired or replaced back to the original condition or better to the satisfaction of the land owner and OWNER.

## **1.13 LANDSCAPING**

- A. All landscaping on private property that is damaged or destroyed during performance of the work shall be repaired or replaced back to the original condition or better to the satisfaction of the land owner and OWNER.

## **1.14 OTHER SURFACE IMPROVEMENTS**

- A. All other surface improvements not explicitly mentioned herein that are damaged or destroyed during performance of the work shall be repaired or replaced back to original condition or better.

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION (Not Used)**

- END OF SECTION –

**SECTION 01 55 26**  
**TRAFFIC CONTROL**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Comply with City of Saratoga Spring traffic control requirements and the following. If there is disagreement, the more stringent requirements shall apply.
- B. CONTRACTOR shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets or highways. If conditions justify, ENGINEER may authorize CONTRACTOR to conduct his work in specific areas and to specific tasks to avoid sporadic and unorganized work efforts.
- C. All work performed on or within the right-of-way of state roads shall have traffic control devices in place before work begins that meet the requirements of Utah Department of Transportation's "Specifications for Excavation on State Highways".
- D. No road shall be closed by CONTRACTOR to the public except by express permission of ENGINEER and after obtaining the required permits. Where it is necessary to close a county or city road to thru traffic, the road shall be closed to thru traffic only - not local traffic. The road shall be closed for one block only, not over 700 feet. The road shall be barricaded at each point of public access with barricades meeting the Utah Department of Transportation's specifications.
- E. Traffic must be kept open on those roads and streets where no detour is possible. CONTRACTOR shall, at all times, conduct his work so as to insure the least possible obstruction to traffic and normal commercial pursuits. All obstructions within traveled roadways shall be protected by approved signs, barricades, and lights where necessary for the safety of the traveling public. The convenience of the general public and residents, and the protection of persons and property are of prime importance and shall be provided for by CONTRACTOR in an adequate and satisfactory manner.
- F. Excavations on project sites from which the public is excluded shall be marked or guarded in a manner appropriate for the hazard.

**1.2 TRAFFIC CONTROL**

- A. For the protection of traffic in public or private streets and ways, CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual on Uniform Traffic Control Devices for Streets and Highways, Part VI - Temporary Traffic Control," published by U.S. Department of Transportation, Federal Highway Administration. CONTRACTOR shall take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. CONTRACTOR shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

- B. If at any time the conditions indicate that CONTRACTOR's protective facilities and service are inadequate to assure the safety of the public or CONTRACTOR's workers, CONTRACTOR shall provide additional facilities or services as may be necessary to assure protection at no additional cost to OWNER.
- C. Where required, CONTRACTOR shall obtain a traffic control permit from the governing agency prior to beginning work, and shall comply with all requirements of the permit.

### **1.3 MEASUREMENT AND PAYMENT**

- A. Traffic Control shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

### **PART 2 PRODUCTS (Not Used)**

### **PART 3 EXECUTION (Not Used)**

- END OF SECTION -



**SECTION 00 56 00**  
**DUST CONTROL**

**PART 1 GENERAL**

**1.1 SCOPE OF WORK**

- A. Comply with City of Saratoga Springs Standards and the following. If there is disagreement, the more stringent requirements shall apply.
- B. Furnish all labor, materials and equipment as required to provide dust control for the project.
- C. All materials and services shall comply with the requirements of the State of Utah, Department of Environmental Quality, Division of Air Quality and the City's Municipal Code.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Water. CONTRACTOR shall be responsible to arrange and pay for water for dust control.
- B. Calcium chloride shall be added to the water used to provide dust control, if required by the City.

**PART 3 EXECUTION**

**3.1 DUST CONTROL**

- A. CONTRACTOR shall comply with the requirements of the State of Utah Department of Environmental Quality, Air Quality Regulations (including R301-205 Emission Standards: Fugitive Emissions and Fugitive Dust, and R307-309 Fugitive Emissions and Fugitive Dust, of the Utah Air Conservation Rules (UACR). CONTRACTOR shall submit a Fugitive Dust Control Plan to the Utah Division of Air Quality, which meets the requirements of R307-309-4. CONTRACTOR shall obtain a permit from the Division of Air Quality.
- B. CONTRACTOR shall execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

**3.2 WATER PLACEMENT FOR DUST CONTROL**

- A. CONTRACTOR is responsible for placement of sufficient water to control dust on the project. Dust control is defined by the permit requirements of the State of Utah, Division of Environmental Quality, Division of Air Quality. Permit shall be obtained by CONTRACTOR.

### **3.3 WATER AND CALCIUM CHLORIDE MIXTURE FOR DUST CONTROL**

- A. CONTRACTOR may also use a water and calcium chloride solution to abate the dust for the project. The mixture of calcium chloride per 10,000-gallon truck shall be 10 pounds. The calcium chloride shall be added to the water truck container as the water is being put into the water truck in order to provide sufficient mixing.
- B. In the absence of providing the water and calcium chloride mixture, CONTRACTOR shall meet the requirements of Subsection 3.2 of this document or shall use other approved methods by OWNER that will allow CONTRACTOR to meet permit requirements.

- END OF SECTION -

**SECTION 01 60 00**  
**PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.1 PRODUCTS**

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- C. Furnish interchangeable components from same manufacturer for components being replaced.

**1.2 PRODUCT DELIVERY REQUIREMENTS**

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

**1.3 PRODUCT STORAGE AND HANDLING REQUIREMENTS**

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**1.4 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

## **1.5 PRODUCT SUBSTITUTION PROCEDURES**

- A. ENGINEER will consider requests for Substitutions only after Notice of Award.
- B. Substitutions may be considered when a product becomes unavailable through no fault of CONTRACTOR.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that CONTRACTOR:
  - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
  - 2. Will provide same warranty for Substitution as for specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to OWNER.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse OWNER for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
  - 1. Submit four copies of request for Substitution for consideration to ENGINEER.
  - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
  - 3. ENGINEER may require CONTRACTOR to provide additional data about the proposed substitution.
  - 4. ENGINEER will be the sole judge as to the type, function, and quality of any such substitution and ENGINEER's decision shall be final.
  - 5. ENGINEER will notify CONTRACTOR in writing of decision to accept or reject request.
  - 6. Acceptance by ENGINEER of a substitution proposed by CONTRACTOR shall not relieve CONTRACTOR of the responsibility for full compliance with the Contract Documents and for the adequacy of the substitution.

## **PART 2 PRODUCTS (Not Used)**

## **PART 3 EXECUTION (Not Used)**

- END OF SECTION -

**SECTION 01 71 13**  
**MOBILIZATION**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section is provided to cover CONTRACTOR's cost of general and miscellaneous responsibilities and operations not normally attributed to, or included in, any other single bid item. This shall include, but not necessarily be limited to, work described or enumerated in this section under the following subsections.

**1.2 MOVING TO AND FROM THE JOB SITE**

- A. This shall include CONTRACTOR's preliminary arrangement for starting and stopping construction operations, work schedules, and transportation of equipment and personnel to and from the project.

**1.3 CLEAN-UP**

- A. The cost of all clean-up Work as specified and not covered under other items shall be included in the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

**1.4 TEMPORARY UTILITIES**

- A. The cost of water, power, etc. required by CONTRACTOR in performing the Work specified in the Contract shall be included in the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

**1.5 PERFORMANCE BOND, PAYMENT BOND, AND INSURANCE**

- A. The cost of the Performance Bond, Payment Bond, and any required insurance and/or other miscellaneous cost associated with this Project shall be included with the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

**1.6 PERMITS**

- A. CONTRACTOR shall provide all necessary permits for completion of the Work. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

**1.7 PRE-CONSTRUCTION VIDEO RECORDS**

- A. CONTRACTOR is required to produce a preconstruction video recording of areas where Work is to be performed. The video record shall be of professional quality and the coverage shall be such, as to allow accurate determination of location, size, and conditions, etc. of existing features and improvements within the rights-of-way. CONTRACTOR shall provide OWNER with a copy of the preconstruction video in DVD format before construction begins.

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION (Not Used)**

- END OF SECTION -

**SECTION 01 78 20**  
**OPERATION AND MAINTENANCE MANUALS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes: Preparation and submittal of Operation and Maintenance Manuals.

**1.2 SUBMITTALS**

- A. Submit for ENGINEER review a compilation of all operation and maintenance manuals (for all project facilities) with a .pdf electronic copy of the PROJECT Operations and Maintenance Manual.
- B. Submit Operation and Maintenance Manuals before field quality control testing and before training of each piece of equipment or system.
- C. Submit 3 hardcopy manuals for each piece of equipment or system.
- D. Submit 1 electronic copy manuals for each piece of equipment or system.
- E. Make manuals available at project site for use by construction personnel and ENGINEER.
- F. Make additions and revisions to the manuals in accordance with ENGINEER's review comments.

**1.3 OPERATION AND MAINTENANCE MANUALS**

- A. CONTRACTOR shall furnish to ENGINEER three (3) identical sets of Operations and Maintenance Manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl, hard-cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A Table of Contents shall be provided which indicates all equipment and suppliers in the Operations and Maintenance Manuals.
- B. CONTRACTOR shall also furnish ENGINEER one copy of the Operations and Maintenance Manuals in PDF electronic format.
- C. CONTRACTOR shall include in the Operations and Maintenance manuals full details for care and maintenance for all visible surfaces as well as the following for each item of mechanical, electrical, and instrumentation equipment (except for equipment furnished by OWNER):
  - 1. Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.
  - 2. Preventative maintenance procedures and schedules
  - 3. A description of proper maintenance activities

4. Complete parts lists, by generic title, identification number, and catalog number, complete with exploded views of each assembly.
  5. Disassembly and reassembly instruction
  6. Name and location of nearest supplier and spare parts warehouse
  7. Name and location of manufacturer
  8. Recommended troubleshooting and start-up procedures
  9. Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.
- D. All Operations and Maintenance manuals shall be submitted in final form to ENGINEER not later than the 75 percent of construction completion date. All discrepancies found by ENGINEER in the Operations and Maintenance manuals shall be corrected by CONTRACTOR prior to final acceptance of the project.
- E. Contents of Operation and Maintenance Manuals:
1. Cover page: Equipment name, tag number, project name, OWNER name, date.
  2. Table of Contents: General description of information provided in each tab section.
  3. Equipment Summary Form:
    - a. Completed form in the format shown in Appendix A.
    - b. The manufacturer's standard form will not be acceptable.
  4. Lubrication information: Required lubricants and lubrication schedules.
  5. Control diagrams:
    - a. Internal and connection wiring, including logic diagrams, wiring diagrams for control panels, ladder logic for computer-based systems, and connections between existing systems and new additions, and adjustments such as calibrations and set points for relays, and control or alarm contact settings.
    - b. Complete set of 11-inch by 17-inch drawings of the control system.
    - c. Complete set of control schematics.
  6. Programming: Copies of all CONTRACTOR furnished programming.
  7. Start-up procedures: Recommendations for installation, adjustment, calibration, and troubleshooting.
  8. Operating procedures:
    - a. Step-by-step procedures for starting, operating, and stopping equipment under specified modes of operation.
    - b. Include safety precautions and emergency operating shutdown instructions.
  9. Preventative maintenance procedures: Recommended steps and schedules for maintaining equipment.
  10. Overhaul instructions: Directions for disassembly, inspection, repair, and reassembly of the equipment; safety precautions; and recommended tolerances, critical bolt torques, and special tools that are required.
  11. Parts list:
    - a. Complete parts list for all equipment being provided.
    - b. Catalog data for all products or equipment furnished including generic title and identification number of each component part of equipment. Include bearing manufacturer, model and ball or roller pass frequencies for every bearing.
  12. Spare parts list: Recommended number of parts to be stored at the site and special storage precautions.



13. Drawings:
  - a. Exploded view or plan and section views with detailed callouts.
  - b. Complete set of 11-inch by 17-inch drawings of equipment.
  - c. Provide electrical and instrumentation schematic record drawings.
14. Source (factory) quality control test results: Provide copies of factory quality control test reports for all equipment.
15. Field quality control test results: After field-testing is completed, insert field test reports for (piping, valving, equipment, and system startup tests), into O&M manual.

#### **1.4 SUPPLEMENT**

A. The supplement below, following “End of Section”, is part of this Specification.

1. Appendix A - Maintenance Summary Form (2 pages).

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

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

- END OF SECTION –

**APPENDIX A - MAINTENANCE SUMMARY FORM**

PROJECT: \_\_\_\_\_ CONTRACT NO.: \_\_\_\_\_

1. EQUIPMENT ITEM \_\_\_\_\_

2. MANUFACTURER \_\_\_\_\_

3. EQUIPMENT/TAG NUMBER(S) \_\_\_\_\_

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) \_\_\_\_\_

5. NAMEPLATE DATA (hp, voltage, speed, etc.) \_\_\_\_\_

6. MANUFACTURER'S LOCAL REPRESENTATIVE \_\_\_\_\_

a. Name \_\_\_\_\_ Telephone No. \_\_\_\_\_

b. Address \_\_\_\_\_

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	Frequency	Lubricant (if applicable)
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

# LUBRICANT LIST

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				

## 9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY.

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

- END OF SUPPLEMENT -

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**SECTION 01 78 50**  
**PROJECT CLOSEOUT**

**PART 1 GENERAL**

**1.1 FINAL CLEANUP**

- A. CONTRACTOR shall promptly remove from the vicinity of the completed Work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the Work by OWNER will be withheld until CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the Project Site.

**1.2 TOUCH-UP AND REPAIR**

- A. CONTRACTOR shall touch up or repair all finished surfaces on structures, equipment, fixtures, etc., that have been damaged prior to final acceptance. Surface on which such touch-up or repair cannot be successfully accomplished shall be completely refinished or in the case of hardware and similar small items, the item shall be replaced.

**1.3 CLOSEOUT TIMETABLE**

- A. CONTRACTOR shall establish dates for equipment testing, acceptance periods and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow OWNER, ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

**1.4 MAINTENANCE AND GUARANTEE**

- A. CONTRACTOR shall comply with the maintenance and guarantee requirements contained in Article 7 of the General Conditions, Section 00 70 00.
- B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as part of such required repair work, and any repair or resurfacing which becomes necessary by reason of such required repair work shall be completed by CONTRACTOR at no cost to OWNER.
- C. CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from OWNER. If CONTRACTOR fails to make such repairs or replacement promptly, OWNER reserves the right to do the work and CONTRACTOR and his surety shall be liable to OWNER for the cost thereof.
- D. CONTRACTOR shall obtain a signed release from the property owner approving restoration of work in the construction easements across or bordering private property.

**1.5 BOND**

- A. CONTRACTOR shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and Article 6 of the General Conditions, Section 00 70 00.

## **1.6 FINAL ACCEPTANCE**

- A. Final acceptance and final payment shall not be made until all provisions of the General Conditions Section 00 70 00 Article 15 have been satisfied.

## **1.7 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed Shop Drawings, Product Data, and Samples.
  - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by OWNER.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Manufacturer's name and product model and number.
  - 2. Product substitutions or alternates utilized.
  - 3. Changes made by Addenda and modifications.
- F. Record Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements
  - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work
  - 3. Field changes of dimension and detail
  - 4. Details not on original Contract drawings
- G. Submit documents to ENGINEER with claim for final Application for Payment.

## **1.8 CONTRACT CLOSEOUT**

- A. As a condition precedent to final acceptance of the project, CONTRACTOR shall complete the following forms and submit the original and two copies of each form to the Project Representative.
  - 1. Contractor's Certificate of Substantial Completion
  - 2. Contractor's Certificate of Final Completion
  - 3. Contractor's Final Waiver of Lien
  - 4. Consent of Surety for Final Payment
  - 5. Affidavit of Payment

6. Affidavit of Release of Liens by the Contractor

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION (Not Used)**

## CONTRACTOR'S CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER

TO:   Name  
          Address  
          City, State, Zip Code

PROJECT: \_\_\_\_\_

ATTENTION: \_\_\_\_\_

FROM: \_\_\_\_\_  
                    Firm or Corporation

This is to certify that I, \_\_\_\_\_ am an authorized official of \_\_\_\_\_  
\_\_\_\_\_ working in the capacity of \_\_\_\_\_  
\_\_\_\_\_ and have been properly authorized by said form or corporation to sign the following  
statements pertaining to the subject contract.

I know of my own personal knowledge, and do hereby certify, that the work of the Contract described above has been substantially performed, and materials used and installed to date in accordance with, and in conformity to, the Contract drawings and specifications. A list of all incomplete work is attached.

The Contractor hereby releases the Owner and its agents from all claims and liability to the Contractor for anything done or finished for or relating to the Work, as specified in the Project Manual, except demands against the Owner for the remainder of progress payments retained to date, and unresolved written claims prior to this date.

The Contract Work is now substantially complete, ready for its intended use, and ready for your inspection. You are requested to issue a Certificate of Substantial Completion.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_



## CONTRACTOR'S CERTIFICATE OF FINAL COMPLETION

OWNER

TO:

Name  
Address  
City, State, Zip Code

PROJECT: \_\_\_\_\_

ATTENTION: \_\_\_\_\_

FROM: \_\_\_\_\_

Firm or Corporation

This is to certify that I, \_\_\_\_\_ am an authorized official of \_\_\_\_\_  
\_\_\_\_\_ working in the capacity of \_\_\_\_\_  
\_\_\_\_\_ and have been properly authorized by said form or corporation to sign the following  
statements pertaining to the subject contract.

I know of my own personal knowledge, and do hereby certify, that the work of the Contract described above has been substantially performed, and materials used and installed to date in accordance with, and in conformity to, the Contract drawings and specifications.

The Contractor hereby releases the Owner and its agents from all claims and liability to the Contractor for anything done or finished for or relating to the Work. The Contract Work is now complete in all parts and requirements, ready for its intended use, excepting the attached list of minor deficiencies and the reason for each being incomplete to date, for which exemption from final payment requirements is requested (if no exemptions requested, write "none") \_\_\_\_\_. The Work is now ready for your final inspection. The following items are required from the Contractor prior to application for final payment and are submitted herewith, if any:

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

I understand that neither the issuance, by the Owner, or a Certificate of Final Completion, nor the acceptance thereof by the Owner, shall operate as a bar claim against the Contractor under the terms of the guarantee provisions of the Contract Documents.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## CONTRACTORS FINAL WAIVER OF LIEN

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has furnished labor and materials for (A) \_\_\_\_\_  
in the City of \_\_\_\_\_, County of \_\_\_\_\_, State of Utah, of which City of \_\_\_\_\_ is the Owner.

NOW THEREFOR, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, for and in consideration of the sum of (B) \_\_\_\_\_ dollars paid simultaneously herewith, the receipt whereof is hereby acknowledged by the undersigned, the undersigned does hereby waive and release any lien\* right to, or claim of lien with respect to and on said above described premises, and the improvements thereon, and on the monies or other consideration due or to become due from the Owner, on account of labor, services, materials, fixtures, apparatus or machinery heretofore or which may hereafter be furnished by the undersigned to or for the above described premises by virtue of said contract.

(C) \_\_\_\_\_ (SEAL)  
(Name of sole ownership, corporation or partnership)

(C) \_\_\_\_\_ (SEAL)  
(Signature of Authorized Representative)

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

### INSTRUCTION FOR FINAL WAIVER:

- A. Project name.
- B. Final Contract amount received (total amount of Contract as adjusted).
- C. If the waiver is for a corporation, corporate name should be used, corporate seal affixed, and title of officer signing waiver should be set forth; if waiver is for a partnership, the partnership name should be used, partner should sign and designate himself/herself as partner.

\* The word Lien as used herein shall include Stop Orders, Stop Notices, or Freeze Orders on monies or other consideration of the Owner which are due or are to become due on the Contract referenced above.

## CONSENT OF SURETY FOR FINAL PAYMENT

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

Location: \_\_\_\_\_

Type of Contract: \_\_\_\_\_

Amount of Contract: \_\_\_\_\_

In accordance with the provisions of the above named contract between the Owner and the Contractor, the following named surety:

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

on the Payment Bond of the following named Contractor:

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

hereby approves of final payment to the Contractor, and further agrees that said final payment to the Contractor shall not relieve the Surety Company named herein of any of its obligations to the following named Owner (as set forth in said Surety Company's bond):

Owners Name  
Owners Address  
City, State, Zip Code

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand and seal this \_\_  
day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
(Name of Surety Company)

\_\_\_\_\_  
(Signature of Authorized Representative)

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

## AFFIDAVIT OF PAYMENT

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by (Insert Owners Name) to furnish labor and materials under a contract dated \_\_\_\_\_ for the project named \_\_\_\_\_ in the City of \_\_\_\_\_ County of \_\_\_\_\_, State of Utah.

NOW THEREFORE, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, the undersigned, as the Contractor for the above named Contract pursuant to the conditions of the Contract, hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or its property might in any way be held responsible.

EXCEPTIONS: (If none, write "none". If required by the Owner, the Contractor furnish bond satisfactory to the Owner for each exception).

{AFFIX CORPORATE}  
{SEAL HERE}

\_\_\_\_\_  
Contractor (Name of sole ownership,  
Corporation or partnership)

\_\_\_\_\_  
(Signature of Authorized Representative)

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

## AFFIDAVIT OF RELEASE OF LIENS BY THE CONTRACTOR

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by (Insert Owners Name) to furnish labor and materials under a contract dated \_\_\_\_\_ for the project named \_\_\_\_\_ in the City of \_\_\_\_\_ County of \_\_\_\_\_, State of Utah.

NOW THEREFOR, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_, the undersigned, as the Contractor for the above named Contract pursuant to the conditions of the Contract, hereby certifies that to the best of his/her knowledge, information and belief, except as listed below, the Releases or Waivers of Lien\* attached hereto include the Contractor, all subcontractors, all suppliers of material and equipment, and all performers of work, labor or services, who have or may have liens against any property of the Owner and on the monies or other consideration due to become due from the Owner arising in any manner in connection with the performance of the Contract referenced above.

EXCEPTIONS: (If none, write "none". If required by the Owner, the Contractor furnish bond satisfactory to the Owner for each exception).

ATTACHMENTS:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Release or Waiver of Liens from subcontractors and material suppliers.

{AFFIX CORPORATE}  
{SEAL HERE}

\_\_\_\_\_  
Contractor (Name of sole ownership,  
Corporation or partnership)

\_\_\_\_\_  
(Signature of Authorized Representative)

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

\* The word Lien as used herein shall include Stop Orders, Stop Notices, or Freeze Orders on monies or other consideration of the Owner which are due or are to become due on the Contract referenced above.

- END OF SECTION -

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**SECTION 03 10 00**  
**CONCRETE FORMING AND ACCESSORIES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section covers the work necessary to furnish, install, and complete, the concrete formwork.

**1.2 RELATED WORK**

- A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00                      Submittal Procedures
2. Section 03 30 00                      Cast-in-Place Concrete

**1.3 MEASUREMENT AND PAYMENT**

- A. Concrete formwork shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

**1.4 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
1. American Concrete Institute (ACI) -ACI 347R- Guide to Formwork for Concrete
  2. American Hardboard Association (AHA) -AHA A135.4- Basic Hardboard
  3. Department of Commerce (DOC) -DOC PS 1- Structural Plywood
  4. ACI 350R-01 – Code Requirements for Environmental Engineering Concrete Structures and Commentary
  5. NSF International (NSF) 61 - Drinking Water System Components - Health Effects

**1.5 DESIGN**

- A. Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the finish specified in Section 03 30 00 Cast-in-Place Concrete. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

**1.6 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. The following shall be submitted:
1. Drawings showing details of forming, shoring and bracing for footings, walls, and floors shall be submitted to ENGINEER at least 3 weeks prior to their use. Drawings showing details of formwork shall include joints, supports, studding and shoring, and sequence of form and shoring removal.

2. If requested by ENGINEER, design analysis and calculations shall be submitted for form design and methodology used in the design. The analysis and calculations shall verify the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, or any other part of forming, shoring or bracing which may be considered critical by ENGINEER.
  3. Manufacturer's data including literature describing form materials, accessories, and form releasing agents.
  4. Manufacturer's recommendation on method and rate of application of form releasing agent.
- C. ENGINEER's review will not relieve CONTRACTOR from any responsibility as to the adequacy of the forming, shoring and bracing design. Any formwork installed by CONTRACTOR shall be solely at CONTRACTOR's risk. ENGINEER's review will not lessen or diminish CONTRACTOR's liability.

## **PART 2 PRODUCTS**

### **2.1 FORM MATERIALS**

- A. Form surfaces shall be in "new and undamaged" condition and may be plywood, hard plastic finished plywood, overlaid waterproof particle board, and steel of sufficient strength and surface smoothness to produce the specified finish. CONTRACTOR shall verify that his types of form surfaces and panel sizes satisfy all requirements of these specifications.
- B. The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

### **2.2 FORM TIES**

- A. Form ties on exposed surfaces shall be located in a uniform pattern. Snap ties shall not be broken until the concrete has reached the design concrete strength. The use of tie wires as form ties will not be permitted. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. Form ties shall be **Plastic Cone Snap Tie by Dayton-Superior, Wrench Head Snap Tie by MASCO Mason Supply**, or approved equal.
- B. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Taper ties shall be **Taper Tie by Dayton-Superior, Taper-Tie by MASCO Mason Supply**, or approved equal.

### **2.3 FORM RELEASING AGENTS**

- A. Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.



- B. Any agents used inside of the reservoir shall consist of products which are certified by laboratories approved by ANSI and shall comply with be NSF Standard 61 for approved use in potable water systems.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03 30 00 Cast-in-Place Concrete. Forms shall be used, whenever necessary, to confine the concrete, to shape the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating. The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar.
- B. The surfaces of all forms in contact with the concrete shall be clean, rigid, tight and smooth. All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited therein.
- C. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be thoroughly cleaned of mortar from previous concreting and of all other dirt and foreign matter before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.
- D. Bulkheads to form vertical wall joints shall be strong enough to withstand concrete pressures during pouring and vibrating, and shall be properly placed between the forms to avoid mortar seepage. Holes shall be provided in the bulkheads to permit passage of horizontal mild steel reinforcing where required by the Contract Drawings. Unless these are specifically called for on the Contract Drawings, no chamfer strips shall be placed in the corners of vertical construction joints.

### **3.2 COATING**

- A. Form inside surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

### **3.3 ALIGNMENT AND TOLERANCES**

Forms shall be properly aligned and adequately supported to produce concrete surfaces conforming to construction tolerance given in Table 03 10 00-1, Tolerances for Formed Surfaces.

TABLE 03 10 00-1  
TOLERANCES FOR FORMED SURFACES

Condition	Measurement	Tolerance
1. Variations from the plumb:	In any 10 feet of length	1/4-inch
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length	1 inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length Maximum for entire length	1/4-inch 1/2-inch
2. Variation from the level or from the grades indicated on the drawings	In any 10 feet of length In any bay or in any 20 feet of length	1/4-inch 3/8-inch
3. Variation of the linear building lines from established position in plan	In any 20 feet Maximum	1/2-inch 1-inch
4. Variation of distance between walls, columns, partitions	1/4-inch per 10 feet of distance, but not more than 1/2-inch in any one bay, and not more than 1-inch total variation	
5. Variation in the thickness of slabs and walls	Minus Plus	1/4-inch 1/2-inch

### 3.4 FORM REMOVAL

- A. Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Forms shall not be removed until approval is given by ENGINEER. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement.
- B. CONTRACTOR shall remove all wood splinters on concrete surfaces after stripping of wood forms.

- END OF SECTION -

**SECTION 03 20 00**  
**CONCRETE REINFORCEMENT**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section covers the reinforcing steel bars, wire fabric or rod mats for cast-in-place concrete.

**1.2 RELATED WORK**

- A. Related Work in other sections includes, but is not limited to:

1. Section 01 33 00                      Submittal Procedures

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

- |             |   |
|-------------|---|
| 1. ACI 301  | Specifications for Structural Concrete  |
| 2. ACI 315  | Details and Detailing of Concrete Reinforcement                                       |
| 3. ACI 318  | Building Code Requirements for Structural Concrete and<br>Commentary                  |
| 4. ACI 350R | Code Requirements for Environmental Engineering Concrete<br>Structures and Commentary |

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                |   |
|----------------|---|
| 1. ASTM A 184  | Standard Specification for Welded Deformed Steel Bar Mats for<br>Concrete Reinforcement                         |
| 2. ASTM A 615  | Standard Specification for Deformed and Plain Carbon-Steel Bars<br>for Concrete Reinforcement.                  |
| 3. ASTM A 767  | Standard Specification for Zinc-Coated (Galvanized) Steel Bars<br>for Concrete Reinforcement                    |
| 4. ASTM A 775  | Standard Specification for Epoxy-Coated Steel Reinforcing Bars  |
| 5. ASTM A 1064 | Standard Specification for Carbon-Steel Wire and Welded Wire<br>Reinforcement, Plain and Deformed, for Concrete |

D. CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

1. CRSI (DA4)                      Manual of Standard Practice (MSP-1)

**1.4 SUBMITTALS**

- A. The following shall be submitted in accordance with Section 01 33 00, Submittal Procedures:

1. Drawings of Concrete Reinforcement System with details showing reinforcing steel schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.
2. Reinforcing Steel with certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel.

## **1.5 DELIVERY AND STORAGE**

- A. Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

## **1.6 MEASUREMENT AND PAYMENT**

- A. Concrete reinforcement shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

# **PART 2 PRODUCTS**

## **2.1 DOWELS**

- A. Dowels shall conform to ASTM A 615, Grade 60.

## **2.2 FABRICATED BAR MATS**

- A. Fabricated bar mats shall conform to ASTM A 184.

## **2.3 REINFORCING STEEL**

- A. Reinforcing steel shall be deformed bars conforming to ASTM A 615 grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 1064. When no grade is indicated use 60 ksi grade steel. Special coated bars (epoxy and zinc) may be specified for use in a highly corrosive atmosphere where concrete cover is not considered sufficient. In which case reference to ASTM A 767 and A 775 will be included.

## **2.4 WELDED WIRE FABRIC**

- A. Welded wire fabric shall conform to ASTM A 1064.

## **2.5 WIRE TIES**

- A. Wire ties shall be 16-gauge or heavier black annealed steel wire.

## **2.6 SUPPORTS**

- A. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI (DA4) MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete.

- B. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within ½ inch of concrete surface shall be plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

## **PART 3 EXECUTION**

### **3.1 REINFORCEMENT**

- A. Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent more than once nor after embedment in concrete.
- B. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety.
- C. Placement:
  - 1. Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.
  - 2. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.
- D. Splicing:
  - 1. Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall be spaced as specified in ACI 318. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device and must be approved by Engineer. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

### **3.2 WELDED-WIRE FABRIC**

- A. Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Lap

splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

### **3.3 DOWELS**

- A. Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately aligned parallel to the finished concrete surface and rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

- END OF SECTION -

**SECTION 03 25 00**  
**EXPANSION JOINTS, CONSTRUCTION JOINTS AND WATERSTOPS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section covers the work necessary to furnish, install and complete expansion and construction joints, including waterstops.
- B. All waterstops and sealants in contact with potable water including waterstops embedded in concrete floors and walls of potable water tanks shall be NSF 61 certified.

**1.2 RELATED WORK**

- A. Related Work in other Sections includes, but is not limited to:

- 1. Section 01 33 00                      Submittal Procedures
- 2. Section 03 33 00                      Cast-in-Place Concrete

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN CONCRETE INSTITUTE (ACI)
  - 1. ACI 318                      Building Code Requirements for Reinforced Concrete
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 53                      Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - 2. ASTM D 412                      Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  - 3. ASTM C 920                      Standard Specification for Elastomeric Joint Sealants
  - 4. ASTM D 570                      Standard Test Method for Water Absorption of Plastics
  - 5. ASTM D 624                      Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
  - 6. ASTM D 638                      Standard Test Method for Tensile Properties of Plastics
  - 7. ASTM D 746                      Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
  - 8. ASTM D 747                      Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
  - 9. ASTM D 792                      Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
  - 10. ASTM D 1751                      Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
  - 11. ASTM D 1752                      Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

12. ASTM D 2240      Standard Test Method for Rubber Property-Durometer Hardness

**D. FEDERAL SPECIFICATIONS (FS)**

1. FS-TT-S-00227E      Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, and Glazing in Buildings and Other Structures)

**E. NSF International (NSF)**

1. NSF/ANSI 61      Drinking Water System Components – Health Effects

**1.4 SUBMITTALS**

- A. The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures:

1. Submit certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified. ENGINEER, may take samples of any materials and have them tested by an independent testing laboratory to verify their compliance with these Specifications. All such costs shall be borne by OWNER. If any materials should fail to meet these Specifications, all costs for further testing of the replacement material shall be borne by CONTRACTOR.
2. Samples of factory fabricated waterstop joints representing in all respects the material and workmanship of the material that will be furnished under this contract. Samples will be submitted and approved by ENGINEER prior to use of the factory joints in the field.
3. Manufacturer's catalog data and manufacturer's recommended instructions for splicing of waterstops.

**1.5 OBSTRUCTIONS**

- A. CONTRACTOR shall pay particular attention to removing all obstructions such as concrete, nails, etc., from joints when movements of floor or wall sections can be expected under temperature and other conditions.

**1.6 QUALITY ASSURANCE**

- A. Waterstop manufacturer shall demonstrate five years (minimum) continuous, successful experience in production of waterstops.

**1.7 DELIVERY AND STORAGE**

- A. Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

**1.8 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for expansion joints, construction joints, and waterstops. Full compensation for expansion joints, construction joints, and waterstops shall be considered as included in the Contract unit or lump sum prices for the various items of the Contract to which it relates.



## PART 2 PRODUCTS

### 2.1 HORIZONTAL JOINT SEALANT

- A. Horizontal joints not requiring waterstops or when so indicated on the Contract Drawings, shall be sealed using **Sikaflex-2c NS**, or approved equal, and shall meet the requirements of ASTM C-920, Type M, Grade NS, Class 25 and FS-TT-S-00227E, Type II, Class A, and shall be NSF 61 certified (Sikaflex 2c NS EZ) if in contact with potable water. Color shall match color of concrete.

### 2.2 VERTICAL JOINT SEALANT

- A. Vertical joints not requiring waterstops or when so indicated on the Contract Drawings, shall be sealed using **Sikaflex-2c NS**, or approved equal, and shall meet the requirements of ASTM C-920, Type M, Grade NS, Class 25 and FS-TT-S-00227E, Type II, Class A, and shall be NSF 61 (Sikaflex 2c NS EZ) certified if in contact with potable water. Color shall match color of concrete.

### 2.3 JOINT PRIMER

- A. All joints receiving a joint sealant shall be primed using **Sikaflex Primers 429/202**, or approved equal.

### 2.4 EXPANSION JOINTS

- A. Expansion joints shall be composed of cellular fibers securely bonded together and uniformly saturated with asphalt. Joint shall be resilient, flexible, and non-extruding. Expansion joints shall meet the requirements of ASTM D 1751. Manufacturer shall be **Fibre Expansion Joint by W.R. Meadows, Fiberflex by JD Russel Company**, or approved equal.

### 2.5 PVC WATERSTOPS

- A. Waterstops shall be of an approved type, supplied by an approved manufacturer and shall be plastic made of virgin polyvinylchloride (PVC) compound, shall be ribbed, uniform in dimensions, dense, homogeneous, free from porosity, and as detailed on the Contract Drawings. No reclaimed PVC shall be used in the compound. Waterstop in contact with potable water shall be NSF 61 certified.

- B. The finished waterstop material shall meet the following minimum requirements:

Tensile strength	2,000 psi min.	(ASTM D 638)
Ultimate elongation	300% min.	(ASTM D 638)
Shore A hardness	75 ± 5	(ASTM D 2240)
Specific gravity	1.38 max	(ASTM D 792)
Stiffness in flexure	600 psi min.	(ASTM D 747)
Cold brittleness	No Failure at -35°F	(ASTM D 746)
Water absorption: 48 hours	0.15% max	(ASTM D 570)
Tear Resistance	290 lb./in. min.	(ASTM D 624)

C. Manufacturer, or approved equal:

1. Vinylex Waterstop & Accessories
2. Greenstreak, Inc. (Sika Corporation)
3. Durajoint Concrete Accessories

D. Factory made waterstop joints shall have a tensile strength across the joint equal to at least 600 psi. Field splices and joints shall be made in accordance with the waterstop manufacturer's instructions using a thermostatically controlled heating iron.

## 2.6 HYDROPHILIC WATERSTOP

A. Non-bentonite rubber hydrophilic waterstop shall only be used where shown on the Contract Drawings or when approved by ENGINEER. Hydrophilic waterstop in contact with potable water including in potable water tank floor slabs and walls shall be NSF 61 certified. Size shall be as indicated on the Contract Drawings.

B. The hydrophilic waterstop shall meet the following physical properties:

Physical Property	Test Method	Result
Tensile Strength (Minimum)	ASTM D412	350 psi
Elongation (minimum)	ASTM D412	600 %
Hardness	ASTM D2240	52 +/-5 Shore A
Tear Resistance	ASTM D624	50 lb/in
Specific Gravity	ASTM D792	1.35 +/-5

C. Manufacturer, or approved equal:

1. Conseal CS-231
2. Sika Hydrotite CJ-1020-2K

## PART 3 EXECUTION

### 3.1 WATERSTOPS

A. Waterstops shall be of the type indicated and shall be installed at the locations shown to form a continuous water-tight diaphragm. The waterstop shall be correctly positioned in the forms so that the center of the waterstop is centered on the joint. Waterstop shall be held in place in the forms by use of a split form or other approved method that will positively hold the waterstop in the correct position and to the correct alignment. Vibrate concrete to obtain impervious concrete in the vicinity of all joints. In horizontal joints, ensure that the areas below the water stop are completely filled with concrete.

B. Horizontal plastic waterstops shall be bent up during placing of concrete until the concrete has been brought to the level of the waterstop; additional concrete shall then be placed over the waterstop, after which the concrete shall be thoroughly vibrated. All horizontal and vertical waterstops, which are not accessible during pouring, shall be tied off in two directions every 12 inches in such a manner that bending over one way or another is prevented. A hog-ring or nail may be driven through both ends of the waterstop to facilitate placing and tying of waterstops to reinforcing steel forms or form-ties.

- C. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. All waterstops shall be properly spliced and joints shall be checked for strength and pinholes after splicing. Splices shall be strong enough to develop a pulling force of 75 percent of the strength of the waterstop, and shall be watertight. Splices in waterstop shall be made in conformance with the recommendations of the waterstop manufacturer. Continuity of cross sectional features shall be maintained across the splice. Splices showing evidence of separation after bending shall be remade.
- D. Install hydrophilic waterstop in accordance with the manufacturer's written instructions. Adhesives used on hydrophilic waterstop shall be NSF 61 certified. Adhesives shall meet the requirements of ASTM C 920 and shall be **Manus Bond 75-AM Lot NSF61, DAP Premium Polyurethane Construction Adhesive**, or approved equal.

### 3.2 JOINTS

- A. Joints shall be installed at locations indicated and as authorized. Joints shall be constructed so as to produce straight joints, and shall be vertical or horizontal, except where walls intersect sloping floors.
- B. Construction Joints
  - 1. Prior to placing the abutting concrete for all construction joints, the contact surface shall be cleaned by approved means to remove all laitance and expose the aggregate. The exposed portion of the reinforcing steel shall be cleaned of all concrete. The cleaning method shall be conducted so as to not damage waterstop, if waterstop is present. Where the joint is to receive a sealant, a recess 3/4-inch deep shall be formed along the joint using a dressed-and-oiled wood strip or other method approved by ENGINEER. The wood strip shall be removed after the concrete has set.
- C. Expansion Joints
  - 1. Expansion joint filler shall be used where required on the Contract Drawings. The edges of the joint shall be neatly finished with an edging tool of 1/8-inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed-and-oiled wood strip temporarily secured to the top thereof to form a recess 3/4-inch deep to be filled with sealant. The wood strip shall be removed after the concrete has set. In lieu of the wood strip a removable expansion filler cap designed and fabricated for this purpose may be used.
- D. Joint Sealant
  - 1. The joint cavity shall be cleaned by sandblasting or power wire brushing and shall be blown clean of dust and sand with compressed air before the joint sealant may be applied. Joints must be frost-free, free of oils, grease, curing compound residues, and any other foreign matter that might prevent bond. A bond breaker tape shall be installed over the joint per manufacturer's instructions. After the joints have been prepared as described above, the joints shall be primed and the sealant shall be applied in accordance with the manufacturer's recommendations.

- END OF SECTION -

**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section covers cast-in-place concrete mix design and placement.
- B. CONTRACTOR shall provide cast-in-place concrete as indicated in the Specifications and the Contract Drawings.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 01 45 00 Quality Control and Material Testing
  - 3. Section 03 10 00 Concrete Forming and Accessories
  - 4. Section 03 20 00 Concrete Reinforcement
  - 5. Section 03 25 00 Expansion Joints, Construction Joints, and Waterstops
  - 6. Section 09 90 00 Painting and Finishes
  - 7. Section 31 23 23 Excavation and Backfill for Structures

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.
- B. AMERICAN CONCRETE INSTITUTE (ACI)
  - 1. ACI 117 Specifications for Tolerances for Concrete Construction and Materials and Commentary
  - 2. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 3. ACI 301 Structural Concrete for Buildings
  - 4. ACI 304 Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 5. ACI 305R Hot Weather Concreting
  - 6. ACI 306R Cold Weather Concreting
  - 7. ACI 318 Building Code Requirements for Structural Concrete and Commentary
  - 8. ACI 350R Code Requirements for Environmental Engineering Concrete Structures and Commentary
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - 2. ASTM C 33 Standard Specification for Concrete Aggregates
  - 3. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
  - 4. ASTM C 42 Standard Test Method for Obtaining and Testing Drilled Cores and

- |                |   |
|----------------|---|
|                | Sawed Beams of Concrete   |
| 5. ASTM C 78   | Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)             |
| 6. ASTM C 94   | Standard Specification for Ready-Mixed Concrete   |
| 7. ASTM C 109  | Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens) |
| 8. ASTM C 143  | Standard Test Method for Slump of Hydraulic-Cement Concrete   |
| 9. ASTM C 150  | Standard Specification for Portland Cement  |
| 10. ASTM C 171 | Standard Specification for Sheet Materials for Curing Concrete  |
| 11. ASTM C 172 | Standard Specification for Sampling Freshly Mixed Concrete  |
| 12. ASTM C 173 | Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method                         |
| 13. ASTM C 192 | Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory                               |
| 14. ASTM C 231 | Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method                           |
| 15. ASTM C 260 | Standard Specification for Air-Entraining Admixtures for Concrete   |
| 16. ASTM C 309 | Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete                                |
| 17. ASTM C 494 | Standard Specification for Chemical Admixtures for Concrete   |
| 18. ASTM C 618 | Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete                     |

D. NSF INTERNATIONAL (NSF)

1. NSF/ANSI 61      Drinking Water System Components - Health Effects.

## 1.4 DEFINITIONS

- A. Average Strength ( $f_{cr}$ ): The required average strength for 30 consecutive strength tests which statistically assures not more than the permissible proportions of tests will fall below Specified Strength.
- B. Specified Strength ( $f'_c$ ): The indicated strength.

## 1.5 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures.
- B. Provide catalog information for all products to be used as part of the submitted mix design.
- C. The results of trial mix designs along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory. Indicate whether mixes have been designed for pumping. Include in the

report the following information:

1. Water-cement ratio.
  2. Proportion of materials in the mix.
  3. Source and type of cement.
  4. Analysis of water to be used unless potable.
  5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.
  6. Slump, air content and temperature of samples.
  7. Unit weight of fresh and dry light weight concrete.
- D. Preapproved Mix Design Data: If supplier has on record, an OWNER approved mix design, submit name and address of supplier for each mix design 1 day prior to using concrete mix.
- E. Certified copies of laboratory test reports, including all test data, for aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. Test reports shall meet the following requirements:
1. Date of mix design: No older than 365 days from the date of submission.
  2. Physical properties of the aggregate: Test results shall not be older than 455 days from the date of submission. A new report will be required if aggregate source is changed.
- F. Cementitious Materials showing Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan.
- G. Submit catalog information on the curing compound and the proposed location to be used.

## **1.6 QUALITY ASSURANCE**

- A. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or aggregate without ENGINEER'S approval.
- B. In proportioning materials for mixing, use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.
- C. Do not change the quantity of cement per cubic yard for approved mix design without written approval of ENGINEER.
- D. Use of admixtures will not relax hot or cold weather placement requirements.
- E. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C-94 and the requirements in this Section.
- F. Tolerances for concrete construction and materials shall be in accordance with ACI 117.

## **1.7 PRODUCT STORAGE AND HANDLING**

- A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and

contaminants.

- B. Stockpile aggregate to avoid segregation and prevent contamination.
- C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

## **1.8 MEASUREMENT AND PAYMENT**

- A. Cast-in-place concrete shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

## **PART 2 PRODUCTS**

### **2.1 ADMIXTURES**

- A. Admixtures shall be approved by ENGINEER prior to use. Any admixtures to be used shall be included in proposed concrete mix designs.
- B. Air Entrainment: ASTM C 260.
- C. Later Reducing and Set Retarding Agents: ASTM C494.
  - 1. Type A: Set water reducing.
  - 2. Type B: Set retarding.
  - 3. Type C: Set accelerating.
  - 4. Type D: Water reducing and set retarding.
  - 5. Type E: Water reducing and set accelerating.
  - 6. Type F: High range water reducing (super plasticizer).\*
  - 7. Type G: High range water reducing and set retarding.\*

\* The relative durability factor of water reducing admixtures shall not be less than 80 and the chlorides content (as Cl-) expressed as a percent of the cement shall not exceed 0.1 percent by weight.

- D. Calcium Chloride: None allowed.
- E. Pozzolan: Pozzolan conforming to the requirements of ASTM C 618, Class F, is allowed as a Portland cement replacing agent under the following conditions:
  - 1. The maximum percentage of Portland cement replacement is:
    - a. 15 percent, for concrete exposed to weather.
    - b. 20 percent, for interior concrete.
  - 2. Pozzolan should not exceed 25% by weight of the cement plus pozzolans.
  - 3. The minimum cement content shall be used in the design formulas before replacement is made.
  - 4. Loss of ignition of pozzolan is less than 3 percent and the water requirement does not exceed 100 percent.
  - 5. All other requirements of this section still apply.
  - 6. Mix designs including trial batches are required for each aggregate source and for each concrete class.

- F. Cementitious Materials showing Manufacturer's certification of compliance,



accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan.

## 2.2 CEMENTITIOUS MATERIALS

- A. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall conform to one of the following:
1. Cement: Use Portland cement, ASTM C 150, Type II, Type IIA, or Type V, low alkali, unless noted otherwise.
  2. Portland - Pozzolan Cement: ASTM C-595, Type IP-A(MS). Do not use Pozzolan cement unless approved by ENGINEER
- B. Only one brand of cement from one manufacturing plant may be used.

## 2.3 AGGREGATES

- A. Aggregates shall be natural aggregates, free from deleterious coatings, and shall conform to the requirements of ASTM C 33, except as modified herein. Aggregates shall not be potentially reactive as defined in Appendix XI of ASTM C 33. CONTRACTOR shall import nonreactive aggregates if local aggregates are reactive.
- B. Fine Aggregates
1. Fine aggregate shall consist of clean, sharp, natural sand and shall conform to the requirements of ASTM C 33. Fine aggregate shall be graded as follows:

FINE AGGREGATES	
Sieve Size	Percent Passing by Weight
3/8 inch	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

2. Fine aggregates shall have no more than two percent by weight passing #200 sieve.

### C. Coarse Aggregate

1. Coarse aggregate shall be washed gravel or crushed stone, or a combination of these materials, consisting of hard, tough, durable particles free from adherent coatings. It shall contain no more than 15 percent flat or elongated particles. A thin, flat or elongated particle is defined as a particle having a maximum dimension in excess of five times its minimum dimension. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered in the work under consideration shall not be used. Coarse aggregate shall be graded as follows (ASTM C 33):

COARSE AGGREGATES	
Sieve Size	Percent Passing by Weight
1 inch	100
3/4 inch	95-100
1/2 inch	25-60
#4	0-10
#8	0-5

2. Coarse aggregates shall have no more than 1.75 percent by weight passing #200 sieve. Proof of gradation will be provided to ENGINEER by CONTRACTOR.

## 2.4 ACI MIX DESIGN

- A. The amount by which the average strength ( $f_{cr}$ ) of a concrete mix exceeds the specified compressive strength ( $f'_c$ ) shall be based upon no more than 1 in 100 random individual strength tests falling more than 500 psi below the specific strength.
- B. Proportion the materials in accordance with ACI 211.1, 211.2 or 211.3 as applicable to produce concrete having the properties or limitations of Table No. 03 30 00-A.

## 2.5 HAND MIXING

- A. Do not hand mix batches exceeding 0.5 cubic yards.
- B. Hand mix only on watertight platform. Mix cement and aggregate prior to adding water.
- C. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.

## 2.6 HEATING, WATER AND AGGREGATE

- A. Do not allow products of fuel combustion to contact the aggregate.
- B. Heat mixing water to maximum temperature of 150 degrees F. Heat aggregates uniformly.
- C. Do not mix cement with water and aggregate at a mix temperature greater than 100 degrees F.

## 2.7 WATER

- A. Water shall be potable, except that non-potable water may be used if it produces mortar cubes having 7- and 28-day strengths at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on mortars, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water for curing shall not contain any substance injurious to concrete, or which causes staining.

## 2.8 PROPORTIONS OF MIX

- A. Mixture Proportioning, Normal Weight Concrete: All concrete that must be watertight

and resistant to freeze-thaw cycles and to naturally occurring or commonly used chemicals should be air entrained. All materials should be proportioned to produce a well-graded mixture of high density and maximum workability with a minimum specified 28 day compressive strength of concrete classification. Trial batches shall contain materials proposed to be used in the project. Trial mixtures having proportions, consistencies and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios. Trial mixes shall be proportioned to produce concrete strengths specified. In the case where ground iron blast-furnace slag is used, the weight of the slag will be substituted in the equations for the term P which is used to denote the weight of pozzolan. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results a curve shall be plotted showing the relationship between water-cement ratio and strength. Maximum water-cement or water-cement plus pozzolan Ratio: 0.45.

- B. Average Strength: In meeting the strength requirements specified, the selected mixture proportion shall produce an average compressive strength exceeding the specified strength by the amount indicated below. Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at other test age designated for determination of the specified strength.

TABLE NO. 03 30 00-A

CONCRETE MIX PROPERTIES (e)			
CONCRETE PROPERTIES	CONCRETE CLASSIFICATION(S)		
	Class 5000	Class 4000	Class 3500
Compressive Strength $f_c$ at 28 days, min., psi	5,000	4,000 (d)	3,500 (d)
Compressive Strength at 7 days, min., psi (a)	3,500	2,800	2,450
Cement content (94 lb. sacks of cement per cubic yard of concrete), min. (b)	6.5	6.0	5.75
Entrained air content, (% by volume).	6±1	6±1	5±1
Slump Range, in. (c)	1 - 4 (f)	2 - 4	2 - 4
Maximum Water Cement Ratio	0.40	0.45	0.45

(a) Used for monitoring purposes only.

(b) May include pozzolan replacements if approved by ENGINEER.

- (c) Not more than 8 inches after adding high range water reducing admixture (super-plasticizer) at site.
- (d) Not allowed if concrete is exposed to freezing and thawing temperatures. Use Class 4000 or higher compressive strength and  $6\pm 1.0$  percent air entrainment.
- (e) All mix designs must be approved by ENGINEER.
- (f) 1-3" for footings, sub-structural walls and 1-4" for slabs, beams, reinforced walls and columns.

## **2.9 CURING MATERIALS**

### **A. Normal Curing Compound**

- 1. Curing compound shall be white pigmented and shall conform to ASTM C 309, Type 2 Class B.
- 2. Sodium silicate compounds cannot be used.
- 3. Manufacturer, or approved equal:
  - a. 1200-White by W.R. Meadows
  - b. White Resin Cure J10W by Dayton Superior
  - c. Safe-Cure 2000 by ChemMasters
  - d. Aqua Kure White by Lambert Corporation

### **B. Dissipating Curing Compound**

- 1. When the curing compound must be removed for finishes or grouting, compounds shall be of a dissipating type, conforming to the requirements of ASTM C 309, Type 1 or Type 2, Class B
- 2. Manufacturer, or approved equal:
  - a. 1100-Clear by W.R. Meadows
  - b. Kurez DR VOX by Euclid Chemical Company
  - c. Clear Cure VOC J7WB by Dayton Superior
  - d. Safe-Cure Clear DR by ChemMasters

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. CONTRACTOR shall inform ENGINEER at least 120 hours in advance of time and places at which CONTRACTOR intends to place concrete. All preparation work for concrete placements shall be substantially completed at least 2 workdays prior to the scheduled start of concrete placement to allow for ENGINEER's review and any necessary corrections.

### **3.2 PREPARATION OF SURFACES**

- A. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance.
- B. Foundations: Earthwork shall be as specified. Flowing water shall be diverted without washing over freshly deposited concrete. Rock foundations shall be cleaned by high velocity air-water jets, sandblasting, or other approved methods. Debris and loose, semi-detached or unsound fragments shall be removed. Rock surfaces shall be moist but without free water when concrete is placed. Semi porous subgrades for foundations and

footings shall be damp when concrete is placed. Pervious subgrades shall be sealed by blending impervious material with the top 6 inches of the in-place pervious material or by covering with an impervious membrane.

- C. Preparation of Previously Placed Concrete: Concrete surfaces to which other concrete is to be bonded shall be roughened in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be moist but without free water when concrete is placed.

### **3.3 INSTALLATION OF EMBEDDED ITEMS**

- A. Embedded items shall be free from oil, loose scale or rust, and paint. Embedded items shall be installed at the locations indicated and required to serve the intended purpose. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.
- B. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations as indicated or shown on the Contract Drawings before pouring concrete. Proper placement and locations shall be the responsibility of CONTRACTOR.

### **3.4 BATCHING, MIXING AND TRANSPORTING CONCRETE**

- A. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and non-agitating units shall comply with NRMCA TMMB-1. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA-QC 3.
- B. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quantity and quality of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by ENGINEER.
- C. Truck mixers and their operation must be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when the specified slump is 3 inches or less, or more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
- D. Admixtures: Admixtures shall be batched within an accuracy of 3 percent. Where two or more admixtures are used in the same batch, they shall be batched separately and must be compatible. Retarding admixture shall be added within one minute after addition of water is complete or in the first quarter of the required mixing time, whichever is first. Superplasticizing admixtures shall be added at the project site, and the concrete with the admixture shall be mixed 4 to 5 minutes before placing as recommended by manufacturer. Concrete that shows evidence of total collapse or segregation caused by

the use of admixture shall be removed from the site.

- E. Control of Mixing Water: No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch. No water shall be added at the jobsite without the approval of ENGINEER.

### **3.5 SAMPLING AND TESTING**

- A. Sampling and Testing of the concrete will be as defined in Section 01 45 00 – Quality Control and Material Testing. If there are discrepancies between this Section and Section 01 45 00, the more stringent requirement shall apply.
  - 1. Aggregates: Aggregates for normal weight concrete shall be sampled and tested in accordance with ASTM C 33.
  - 2. Sampling of Concrete: Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C 172.
    - a. Air Content: Test for air content shall be performed in accordance with ASTM C 173 or ASTM C 231. A minimum of 1 test shall be conducted each time a slump test is made.
    - b. Slump: At least 1 slump test shall be made on randomly selected batches of each mixture of concrete for every 100 cubic yards of ready-mixed concrete delivered to the job site. Also note the time batched at the plant and the starting time when unloading began at the site. Tests shall be performed in accordance with ASTM C 143.
    - c. Temperature: Concrete and air temperatures shall be measured and recorded with each slump test or with each set of cylinders and the air temperature shall also be recorded when the air temperature at the site is 40 degrees F or below and/or 90 degrees F or above.
  - 3. Evaluation and Acceptance of Concrete
    - a. Frequency of Testing: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 3,000 square feet of surface area for slabs or walls. If this sampling frequency results in less than 5 strength tests for a given class of concrete, tests shall be made from at least 5 randomly selected trucks or from each truck if fewer than 5 truck loads are used. Field cured specimens for determining form removal time or when a structure may be put in service shall be made in numbers directed to check the adequacy of curing and protection of concrete in the structure. The specimens shall be removed from the molds at the age of 24 hours and shall be cured and protected, insofar as practicable, in the same manner as that given to the portion of the structure the samples represent.
    - b. Testing Procedures: Cylinders for acceptance tests shall be molded and cured in accordance with ASTM C 31. Cylinders shall be tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at another specified test age.
    - c. Evaluation of Results: Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the required strength by more than 500 pounds per square inch.

- d. Unless noted otherwise, make a minimum of five (5) concrete cylinders each time a test is required. When concrete is being placed in suspended slabs, beams and retaining walls make two (2) extra cylinders which must be cured on site. The extra cylinders will be used to determine when to remove forms and/or when to backfill.
- B. Investigation of Low-Strength Test Results: When any strength test of standard-cured test cylinder falls below the specified strength requirement by more than 500 pounds per square inch, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C 597, ASTM C 803 or ASTM C 805 may be permitted by ENGINEER to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection. When strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by ENGINEER to least impair the strength of the structure. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for seven days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C 42. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to or at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. If the core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be directed by ENGINEER in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to ENGINEER. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by ENGINEER, at the expense of CONTRACTOR.

### **3.6 CONVEYING CONCRETE**

- A. Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph 3.7 CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients. Conveying concrete shall be in accordance with the requirements of ACI 304.
  - 1. Chutes: When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.
    - a. Use metal or metal lined chutes with a maximum length of 20-feet.
    - b. The minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them.
  - 2. Buckets: Bucket design shall be such that concrete of the required slump can be readily discharged. Bucket gates shall be essentially grout tight when closed. The bucket shall provide means for positive regulations of the amount and rate of deposit

- of concrete in each dumping position.
3. Pumps: Concrete may be conveyed by positive displacement pumps when approved. Pump shall be the piston or squeeze pressure type. Pipeline shall be steel pipe or heavy duty flexible hose. Inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place. After each use, the equipment shall be thoroughly cleaned. Flushing water shall be wasted outside the forms.

### **3.7 CONCRETE PLACEMENT**

- A. Mixed concrete which is transported in truck mixers or agitators or concrete which is truck mixed, shall be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by ENGINEER if the concrete is of such slump after the 1-1/2 hour time or 300 revolution limit has been reached that it can be placed, without the addition of water to the batch. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the truck.
1. Placing Operation: Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by CONTRACTOR prevent proper consolidation, finishing and curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 4 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Concrete should not be allowed to drop through a cage of reinforcing steel. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screened to the proper level to avoid excessive shimming or grouting.
  - a. Additional requirements for depositing concrete in walls include, but are not limited to:
    - 1) Deposit concrete in a continuous operation until section is completed.
    - 2) Place concrete in approximately horizontal layers 2 ft maximum thickness.
    - 3) Each layer of concrete shall be plastic when covered with following layer.
    - 4) Rate of vertical rise not more than 4 ft per hour.
    - 5) Pump concrete or use a tremie having varying lengths for placing concrete in columns and walls to prevent free fall of more than 4 ft.
    - 6) Allow concrete to thoroughly settle before top is finished. Remove all laitance, debris, and surplus water from surfaces at tops of forms by screeding, scraping, or other effective means.
  - b. Additional requirements for depositing concrete in slabs include, but are not limited to:



- 1) Deposit concrete in a continuous operation until section is completed.
  - 2) Concrete shall be deposited as nearly as practicable to its final position to avoid segregation due to rehandling or flowing.
  - 3) In sloping slabs, proceed uniformly from the bottom of the slab to the top for the full width of the placement.
2. Consolidation: Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 8,000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then withdrawn slowly. The use of form vibrators must be specifically approved. Vibrators shall not be used to transport concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique.
- B. Cold Weather Requirements: Cold weather requirements shall conform to ACI 306 and this Specification. Special protection measures, approved by ENGINEER, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. Provisions should be made to keep the concrete at a minimum temperature of 50 degrees F for 7 days. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 32 degrees F. No concrete shall be placed on frozen ground. The temperature of the concrete when placed shall be not less than 55 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used.
- C. Hot Weather Requirements: Hot weather requirements shall conform to ACI 305 and this Specification. The temperature of the concrete placed during hot weather shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

### **3.8 CONSTRUCTION JOINTS**

- A. Construction joints shall be located as indicated on the Contract Drawings. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of ENGINEER. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete is no longer plastic, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top

and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints are required, a strip of 1-inch square-edge lumber, beveled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph 3.2, PREPARATION OF SURFACES.

### **3.9 FINISHING CONCRETE**

#### **A. Formed Surfaces**

1. **Repair of Surface Defects:** Surface defects shall be repaired within 24 hours after the removal of forms. Honeycombed and other defective areas shall be cut back to solid concrete or to a depth of not less than 1 inch, whichever is greater. Edges shall be cut perpendicular to the surface of the concrete. The prepared areas shall be dampened and brush-coated with neat cement grout. The repair shall be made using mortar consisting of not more than 1 part cement to 2-1/2 parts sand. The mixed mortar shall be allowed to stand to stiffen (approximately 45 minutes), during which time the mortar shall be intermittently remixed without the addition of water. After the mortar has attained the stiffest consistency that will permit placing, the patching mix shall be thoroughly tamped into place by means approved by ENGINEER and finished slightly higher than the surrounding surface. For Class A and Class B finished surfaces the cement used in the patching mortar shall be a blend of job cement and white cement proportioned to produce a finished repair surface matching, after curing, the color of adjacent surfaces. Holes left after the removal of form ties shall be cleaned and filled with patching mortar. Holes left by the removal of tie rods shall be reamed and filled by dry-packing. Repaired surfaces shall be cured as required for adjacent surfaces. The temperature of concrete, mortar patching material, and ambient air shall be above 50 degrees F while making repairs and during the curing period. Concrete with defects which affect the strength of the member or with excessive honeycombs will be rejected, or the defects shall be corrected as directed by ENGINEER.
2. **Class A Finish:** Where a Class A finish is indicated, fins shall be removed. A mortar mix consisting of one-part Portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be prepared. White cement shall be used to replace part of the job cement. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood-floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads until all visible grout film is removed. The rubbing pads shall have on their surfaces the same sand-cement mix specified above but without any mixing water. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas.

3. Class B Finish: Where a Class B finish is indicated, fins shall be removed. Concrete surface shall be smooth with a texture at least equal to that obtained through the use of Grade B-B plywood forms.
  4. Class C Finish: Where a Class C finish is indicated, fins shall be removed. Concrete surfaces shall be relatively smooth with a texture imparted by the forms used.
  5. Class D Finish: Where a Class D finish is indicated, fins exceeding 1/4 inch in height shall be chipped or rubbed off. Concrete surfaces shall be left with the texture imparted by the forms used.
  6. See Specification Section 09 90 00 Painting and Finishes for required finishes.
- B. Unformed Surfaces: In cold weather, the air temperature in areas where concrete is being finished shall not be less than 50 degrees F in accordance with ACI 306R. In hot windy weather when the rate of evaporation of surface moisture, as determined by methodology presented in ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour; coverings, windbreaks, or fog sprays shall be provided as necessary to prevent premature setting and drying of the surface. The dusting of surfaces with dry materials or the addition of water during finishing will not be permitted. Finished surfaces shall be plane, with no deviation greater than 5/16-inch when tested with a 10-foot straightedge. Surfaces shall be pitched to drains.
1. Rough-Slab Finish: Slabs to receive fill or mortar setting beds shall be screened with straightedges immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible.
  2. Float Finish: Slabs to receive a steel trowel finish and slabs where indicated shall be given a float finish. Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened to permit the operation and the water sheen has disappeared, it shall be wood floated. Concrete that portrays stickiness shall be finished with a magnesium float in lieu of a wood float, and left free of ridges and other projections. Float finish is normally specified for surfaces that will receive other treatment such as built-up roofing, nonslip surfacing material. Float Finish shall not be used on wearing surfaces.
  3. Trowel Finish: Slabs where indicated, shall be given a trowel finish immediately following floating. Surfaces shall be trowelled to produce smooth, dense slabs free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. A final hard steel troweling shall be done by hand. Trowel finish shall be used on wearing surfaces and where a smooth finish is required.
  4. Broom Finish: After floating, slabs where indicated, shall be lightly troweled, and then broomed with a fiber-bristle brush in a direction transverse to that of the main traffic.
  5. See Specification Section 09 90 00 Painting and Finishes for required finishes.

### **3.10 CURING AND PROTECTION**

- A. General: All concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
Concrete with Type II or IIA, or V, low alkali cement	7 days

- B. Immediately after placement, concrete shall be protected from premature drying extremes in temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. All materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time. Curing shall be accomplished by any of the following methods, or combination thereof, as approved.
- C. Moist Curing: Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap. Once the moist curing has started the concrete surface must not be allowed to become surface dry for the entire curing period.
- D. Membrane Curing:
1. Normal membrane curing compound shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete. Use a Dissipating curing compound for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring.
  2. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam.
  3. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface.
  4. Surfaces shall be thoroughly moistened with water and the curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period.
  5. Compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions.
  6. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified.
  7. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun for the duration of the curing period.

8. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

### **3.11 QUALITY CONTROL TESTING**

- A. Quality Control Testing shall be in accordance with Section 01 45 00 – Quality Control and Material Testing.

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## **SECTION 03 31 05**

### **CONTROLLED LOW STRENGTH MATERIAL**

#### **PART 1 GENERAL**

##### **1.1 REQUIREMENTS**

- A. CONTRACTOR shall provide Controlled Low Strength Material (CLSM), complete and in place, in accordance with the Contract Documents.
- B. CLSM shall be placed where indicated and may be used, if ENGINEER approves, for the following purposes:
  - 1. Normal CLSM with high slump, non-segregating consistency that readily flows and fills voids and difficult to reach places: pipe zone fill, trench zone fill, pipe abandonment, structure backfill, and structure cavity fill.
  - 2. Foundation CLSM is used where higher early strengths are required and future excavation is not likely to be required.

##### **1.2 RELATED WORK**

- A. Related work in other sections includes but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 31 23 15 Excavation and Backfill for Buried Pipelines

##### **1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM C 33 Standard Specification for Concrete Aggregates
  - 2. ASTM C 94 Standard Specification for Ready-Mixed Concrete
  - 3. ASTM C 138 Standard Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
  - 4. ASTM C 150 Standard Specification for Portland Cement
  - 5. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete.
  - 6. ASTM C 403 Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
  - 7. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
  - 8. ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
  - 9. ASTM C 803 Standard Test Method for Penetration Resistance of Hardened Concrete
  - 10. ASTM D 4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
  - 11. ASTM D 4832 Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

## **1.4 SUBMITTALS**

- A. Submittals shall be furnished in accordance with Section 01 33 00 Submittal Procedures.
- B. Shop Drawings:
  - 1. CLSM mix designs which show the proportions and gradations of all materials proposed for each type of CLSM indicated. Each mix design shall be accompanied by independent laboratory test results of the indicated properties.
  - 2. If Contractor proposes to provide lower strength CLSM with aggregates that do not conform to ASTM C 33, Shop Drawings shall include a testing program that will be used to control the variability of the aggregates. The testing program shall be acceptable to ENGINEER.

## **1.5 QUALITY ASSURANCE:**

- A. All testing will be done by a testing laboratory at CONTRACTOR'S expense, except as otherwise indicated.
- B. If tests of the CLSM show non-compliance with the specifications, CONTRACTOR shall make changes as may be required to achieve compliance. Performing and paying for subsequent testing to show compliance shall be CONTRACTOR's responsibility.
- C. Correlation Tests
  - 1. CONTRACTOR shall perform a field correlation test for each mix of CLSM used in pipe zone, trench zone, or backfill used in amounts greater than 100 cubic yards or when CLSM is required to support traffic or other live loads on the fill less than 7 days.
  - 2. Field correlation tests shall be performed in a test pit similar in cross section to the WORK and at least 10-feet long at a location near the WORK. The proposed location shall be acceptable to ENGINEER.
  - 3. Laboratory and field tests shall be performed on samples taken from the same CLSM batch mix. All tests shall be performed by a laboratory at CONTRACTOR's expense.
  - 4. Testing shall be performed once each 2-hours during the first 8 hours, once each 8-hours during the first week, and once each 24-hours until the CLSM mix reaches the maximum design strength.
    - a. Compression testing shall be in accordance with ASTM D 4832.
    - b. Setting test shall be in accordance with ASTM C 403.
    - c. Density tests shall be in accordance with ASTM C 138.

## **PART 2 PRODUCTS**

### **2.1 CONTROLLED LOW STRENGTH MATERIAL**

- A. CLSM shall be a mixture of cement, pozzolan, coarse and fine aggregate, admixtures, and water, mixed in accordance with ASTM C 94.
- B. Composition: The following parameters shall be within the indicated limits and as necessary to produce the indicated compressive strengths.



1. The actual mix proportions and flow characteristics shall be determined by the producer of the CLSM to meet requirements for compressive strength as specified for Normal CLSM or Foundation CLSM.
2. Entrained air content shall be between 15 percent minimum and 30 percent maximum.
3. Water reducing agent content as necessary.

C. Properties

1. Density shall be between 120 PCF minimum and 145 PCF maximum.
2. Slump shall be as required by CONTRACTOR methods, but shall not promote segregation, nor shall slump exceed 10 inches.
3. Compressive strength at 28 days:
  - a. Normal CLSM: Between 100 psi minimum and 300 psi maximum. Unless specifically indicated otherwise, all CLSM shall be Normal CLSM.
  - b. Foundation CLSM: 500 psi to 1,000 psi.

## **2.2 CEMENT**

- A. Cement shall be Type II in accordance with ASTM C 150.

## **2.3 POZZOLAN**

- A. Pozzolan shall be Type F or C in accordance with ASTM C 618. Pozzolan content, by weight, in Normal CLSM, shall not be greater than 90 percent.

## **2.4 AGGREGATE**

- A. Aggregate shall consist of a well graded mixture of crushed rock, soil, or sand, with a nominal maximum size of 3/8-inch. One hundred percent shall pass the 1 inch sieve; no more than 30 percent shall be retained on the 3/8-inch sieve; and no more than 12 percent shall pass the number 200 sieve. If more than 5 percent of the aggregate passes the number 200 sieve, the material passing the number 200 sieve shall have a plasticity index of less than 0.73(liquid limit-20), when tested in accordance with ASTM D 4318. All aggregate shall be free from organic matter and shall not contain more alkali, sulfates, or salts than the native materials at the Site.

## **2.5 ADMIXTURES**

- A. Air entraining admixtures shall be in accordance with ASTM C 260.
- B. Water reducing admixtures shall be in accordance with ASTM C 494.

## **2.6 WATER**

- A. Water shall be potable, clean, and free from objectionable quantities of silt, organic matter, alkali, salt, and other impurities.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Subgrade and compacted fill to receive CLSM shall be prepared according to Section 31 23 15 Excavation and Backfill for Buried Pipelines.

### **3.2 BATCHING, MIXING AND DELIVERY**

- A. Batching, mixing, and delivery of CLSM shall conform to ASTM C 94. CLSM shall be mixed at a batch plant acceptable to the ENGINEER and shall be delivered in standard transit mix trucks.

### **3.3 PLACEMENT**

- A. CLSM shall be placed by tailgate discharge, conveyor belts, pumped, or other means acceptable to the ENGINEER. CLSM shall be directed in place by vibrator, shovel, or rod to fill all crevices and pockets. Avoid over-consolidation which causes separation of aggregate sizes.
- B. CLSM shall be continuously placed against fresh material unless otherwise approved by ENGINEER. When new material is placed against existing CLSM, the placement area shall be free from all loose and foreign material. The surface of the existing material shall be soaked a minimum of one hour before placement of fresh material but no standing water shall be allowed when placement begins.
- C. CLSM placement for piping. Pipe shall be placed on soil pads and bedding placed under the pipe from one side and vibrated, as necessary, so that the CLSM flows to the opposite side. CLSM shall then be added to both sides of the pipe and vibrated until it fills the space between the pipe and the excavated trench bottom. CLSM shall be deposited in such a manner as to avoid uplift and deposited in its final position to avoid disturbing the pipe trench causing foreign material to mix with the cement slurry.
- D. Pipe zone backfill shall not be placed or compacted until the CLSM has reached initial set. Pipes placed on steep slopes may require a stiffer mix to prevent CLSM from flowing down the trench. Vibration may be required to ensure that the CLSM fills all voids.
- E. Temperature of the CLSM shall be between 50 and 90 degrees F, when placed. CLSM shall not be placed when the air temperature is below 40 degrees F. No CLSM shall be placed against frozen subgrade or other materials having temperature less than 32 degrees F.

### **3.4 FINISHING**

- A. The finish surface shall be smooth and to the grade indicated or directed by the ENGINEER. Surfaces shall be free from fins, bulges, ridges, offsets, and honeycombing. Finishing by wood float, steel trowel, or similar methods is not required.

### **3.5 CURING**

- A. CLSM shall be kept damp for a minimum of 7 days or until final backfill is placed.

### **3.6 PROTECTION**

- A. CLSM shall be protected from freezing for 72 hours after placement.
- B. No fill or loading shall be placed on CLSM until probe penetration resistance, as measured in accordance with ASTM C 803 exceeds 650 psi.
- C. CLSM shall be protected from running water, rain, and other damage until the Material has been accepted and final fill completed.

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**SECTION 03 60 00**  
**GROUT**

**PART 1 GENERAL**

**1.1 REQUIREMENTS**

- A. CONTRACTOR shall provide grout, complete and in place, in accordance with the Contract Documents.
- B. Unless indicated otherwise, grouts shall be provided as listed in this Section whether indicated on the Contract Drawings or not.
- C. The following types of grouts are covered in this Section:
  - 1. Cement Grout
  - 2. Non-Shrink Grout – Class I (cement based)
  - 3. Non-Shrink Grout – Class II (cement based)
  - 4. Non-Shrink Epoxy Grout
  - 5. Epoxy Anchor Grout for Adhesive Anchors
  - 6. Topping Grout and Concrete/Grout Fill

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 01 60 00 Product Requirements
  - 3. Section 03 30 00 Cast-in-Place Concrete

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. American Society for Testing Materials (ASTM)
  - 1. ASTM C 33           Standard Specification for Concrete Aggregates
  - 2. ASTM C 136       Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
  - 3. ASTM C 150       Standard Specification for Portland Cement
  - 4. ASTM C 307       Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
  - 5. ASTM C 494       Standard Specification for Chemical Admixtures for Concrete
  - 6. ASTM C 496       Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
  - 7. ASTM C 531       Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

- |                 |   |
|-----------------|---|
| 8. ASTM C 579   | Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes                       |
| 9. ASTM C 580   | Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes |
| 10. ASTM C 827  | Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures   |
| 11. ASTM C 881  | Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete  |
| 12. ASTM C 882  | Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear   |
| 13. ASTM C 939  | Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)  |
| 14. ASTM C 942  | Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory  |
| 15. ASTM C 1090 | Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout   |
| 16. ASTM C 1107 | Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)   |
| 17. ASTM C 1339 | Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts  |
| 18. ASTM D 648  | Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position  |
| 19. ASTM D 695  | Standard Test Method for Compressive Properties of Rigid Plastics   |

#### **1.4 CONTRACTOR SUBMITTALS**

- A. Submittals shall be furnished in accordance with Section 01 33 00 Submittal Procedures.
- B. Provide the following submittals for each type of grout used on the project:
  - 1. Test reports accompanied by a manufacturer's statement that previously tested material is of similar type, quality, and manufacture as that which is proposed for use on this project shall be submitted for:
    - a. Cement
    - b. Aggregates
    - c. Retardants
    - d. Bonding compounds
    - e. Epoxy Resin
  - 2. Certifications that grouts used on the project contain no chlorides or other chemicals that cause corrosion.
  - 3. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use. ICBO/ES report shall be submitted for epoxy anchor grout for adhesive anchors.

4. Manufacturer's certification that non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.
5. Submit manufacturer's written warranty as indicated herein.
6. Name and telephone number of grout manufacturer's representative who will give on-Site service. The representative shall have at least one year of experience with the indicated grouts.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Grout and grout materials shall be stored in a dry shelter, protected from moisture, and for prepackaged grout, maintained in accordance with the manufacturer's recommendations.

## **1.6 QUALITY ASSURANCE**

- A. The work shall be subject to inspection at all times by OWNER and ENGINEER for the purpose of determining that the work is properly executed in accordance with this specification. Failure to detect defective workmanship or material during any interim inspection shall not constitute acceptance of workmanship and materials.
- B. All testing will be done by a testing laboratory at CONTRACTOR'S expense, except as otherwise indicated.
- C. Field Tests
  1. Compression test specimens will be taken from the first placement of each type of grout, and at intervals thereafter selected by ENGINEER.
  2. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C 1107, at intervals during construction selected by ENGINEER. A set of 3 specimens will be made for testing at 7 Days, 28 Days, and each additional time period as appropriate.
  3. Compression tests and fabrication of specimens for topping grout and concrete/grout fill will be performed in accordance with Section 03 31 00 - Cast-in-Place Concrete, at intervals during construction selected by ENGINEER.
  4. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C 579, Method B, at intervals during construction selected by ENGINEER. A set of 3 specimens will be made for testing at 7 Days and each earlier time period as appropriate.
- D. Construction tolerances shall be as indicated in Section 03 31 00 Cast-in-Place Concrete unless noted otherwise.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Cement: Portland cement shall be ASTM C 150 Type II of Type V.

B. Aggregate:

1. General: Aggregate shall be non-reactive and shall be washed before use. When sources of aggregate are changed, test reports shall be provided for the material from the new source prior to commencing grout work.
2. Fine Aggregate: Fine aggregate shall be sand or crush stone conforming to ASTM C 33 as modified herein. When tested in accordance with ASTM C 136, gradation shall be such that 100 percent by weight passes a No. 8 sieve and not less than 45 percent by weight passes a standard No. 40 sieve. Variation from the specified gradation in individual tests will be accepted if the average of three consecutive tests is within the following variation:

Standard Sieve	Permissible Variation in Individual Test
No. 30 or coarser	2% by weight
No. 50 or finer	0.5% by weight

C. Admixtures

1. General: Admixtures shall be compatible with the grout and shall comply with the manufacturer's recommendations. Admixtures shall be added to the grout mix separately.
2. Water Reducing Retarder: Water reducing retarder shall comply with ASTM C 494, Type D and shall be **Master Builders (BASF) MasterSet R 300, Sika Corporation Plastiment**, or approved equal.
3. Lubricant: Lubricant additive for cement pressure grouting shall be **Sika Intraplast**, or approved equal.

D. Water:

1. Water for washing aggregate, for mixing and for curing shall be potable, shall not contain more than 1,000 mg/L of chlorides as Cl, nor more than 1,300 mg/L of sulfates as SO<sub>4</sub>, and shall not contain impurities which may change the setting time by more than 25 percent or a reduction of more than 5 percent of the compressive strength of the grout at 14 days when compared to the results for grout made with distilled water.

## 2.2 CEMENT GROUT

- A. Application: Surface repairs of concrete.
- B. Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 Days shall be 4000 psi.
- C. Cement grout materials shall be as indicated in Section 03 31 00 Cast-in-Place Concrete.

## 2.3 NON-SHRINK GROUT



#### A. General

1. Non-shrink cementitious grout shall be a flowable, prepackaged, inorganic, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used. The manufacturer shall have at least 10 years' experience in the manufacture of cement based grouts. The manufacturer shall provide technical services and provide a representative at the jobsite for product training prior to product installation.
2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the particular application.
3. Grout shall not contain chlorides or additives that may contribute to corrosion.
4. Grout shall be formulated to be used at any consistency from fluid to plastic.
5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:
  - a. Minimum tensile splitting strength of 500 psi per ASTM C 496.
  - b. Minimum flexural strength of 1,000 psi per ASTM C 580.
  - c. Minimum bond strength (concrete to grout) of 1,900 psi per modified ASTM C 882.
  - d. Grout shall be certified for use in freeze/thaw environments.

#### B. Class I Non-Shrink Grout

1. Application: Anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F or in high fire risk areas; Beam and column (1 or 2 story) base plates less than 16-inches in the least dimension; Storage tanks and other non-motorized equipment and machinery under 30 horsepower; Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.; Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material; and any other location not specifically listed in this Section or on the Contract Drawings.
2. Class I non-shrink grout shall have a minimum 28 Day compressive strength of 5,000 psi when mixed at a fluid consistency.
3. Class I non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.
4. Grout shall have a maximum early age height change of 4.0% expansion, and shall have no shrinkage (0.0%) in accordance with ASTM C 827. The grout when tested shall not bleed or segregate at maximum allowed water.
5. Grout shall have no shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with ASTM C 1090.
6. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.
7. Class I Non-Shrink Grout shall be **Five Star Grout by Five Star Products, Sikagrout 212 by Sika Corporation, CB-G PG by Hilti**, or equal.

#### C. Class II Non-Shrink Grout

1. Application: Column base plates (greater than 2 story or larger than 16-inches in the least dimension); under precast concrete elements; and repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials.
2. Class II non-shrink grout shall be a high precision, fluid, extended working time, grout. The minimum 28-Day compressive strength shall be 7,500 psi, when mixed at a fluid consistency.
3. Grout shall have a maximum early age height change of 4.0% expansion, and shall have no shrinkage (0.0%) in accordance with ASTM C 827.
4. Grout shall have no shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with ASTM C 1090.
5. Class II non-shrink grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C 827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C 1107.
6. Class II non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C 939.
7. The grout when tested shall not bleed or segregate at maximum allowed water content.
8. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.
9. Class II non-shrink grout shall be **Five Star Fluid Grout 100 by Five Star Products, Crystex by L&M Construction Chemicals**, or equal.

## 2.4 NON-SHRINK EPOXY GROUT

- A. Application: Pumps over 1,000 horsepower, unless indicated otherwise.
- B. Non-shrink epoxy grout shall be a flowable, non-shrink, 100 percent solids system. The epoxy grout system shall have 3 components: resin, hardener, and specially blended aggregate, each premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.
- C. Epoxy grout shall have a maximum early age height change of 4.0% expansion, and shall have no shrinkage (0.0%) in accordance with ASTM C 827, (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).
- D. Epoxy grout shall have a negligible (less than 0.0006 in/in) length change after hardening, and a coefficient of thermal expansion less than  $18 \times 10^{-6}$  in/in F when tested according to ASTM C 531.
- E. The epoxy grout shall develop a minimum compressive strength of 9,000 psi in 24 hours and 13,000 psi in seven days when tested in accordance with ASTM C 579, method B.
- F. The mixed epoxy grout shall have a minimum working life of 90 to 120 minutes at 70 degrees F.

- G. The effective bearing area shall be a minimum of 95 percent EBA in accordance with ASTM C 1339.
- H. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application. Do not reduce aggregate loading or add solvents to increase flowability.
- I. Non-shrink epoxy grout shall have the following minimum properties when tested at 7 Days:
  - 1. Minimum bond strength to concrete of 3,000 psi per ASTM C 882 modified.
  - 2. Minimum bond strength to steel of 1,700 psi per ASTM C 882 modified.
  - 3. Minimum flexural strength of 2,500 psi per ASTM C 580.
  - 4. Minimum tensile strength of 2,000 psi per ASTM C 307.
- J. Non-shrink epoxy grout shall be **Five Star DP Epoxy Grout by Five Star Products, Inc., Sikadur 42 Grout-Pak by Sika Corporation**, or equal.

## 2.5 EPOXY ANCHOR GROUT

- A. Application: Anchor bolts and reinforcing steel required to be set in grout that is not in high temperature or high fire risk areas.
- B. Epoxy anchor grout shall conform to ASTM C 881, Type IV, Class A, B, and C, Grade 3 with the exception of gel time.
- C. Heat deflection temperature shall be a minimum of 139 °F per ASTM D 648.
- D. Manufacturer shall certify that the epoxy anchor grout will maintain 90 percent of its strength up to a temperature of 125 °F.
- E. Grout shall come in a 2 chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.
- F. Epoxy anchor grout shall be capable of being used in submersed applications once cured.
- G. Minimum compressive strength shall be 12,000 psi per ASTM D 695.
- H. Overhead anchors and anchors in fire-resistive construction shall be cast-in anchors.
- I. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar. Embedment shall not exceed 67 percent of the member depth.
- J. Epoxy anchor grout shall be **Epcon C6+ by ITW Ramset/Red Head, Power-Fast Epoxy Injection Gel by Powers Fasteners, RE 500 by Hilti**, or equal.

## 2.6 TOPPING GROUT AND CONCRETE/GROUT FILL

- A. Where fill is thicker than 3-inches, structural concrete as indicated in Section 03 31 00 - Cast-in-Place Concrete, may be used when accepted by ENGINEER.

- B. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and be mixed as indicated. Materials and procedures indicated for normal concrete in Section 03 31 00 - Cast-in-Place Concrete, shall apply unless indicated otherwise.
- C. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Topping grout in clarifiers shall contain between 750 and 800 pounds of cement per cubic yard with a maximum water cement ratio of 0.42.
- D. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent By Weight Passing
1/2 in	100
3/8 in	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

- E. Final mix design shall be as determined by trial mix design as indicated in Section 03 30 00 - Cast-in-Place Concrete.
- F. Topping grout and concrete grout/fill shall contain air-entraining agent per Section 03 30 00 – Cast-in-Place Concrete.
- G. **Strength:** Minimum compressive strength of topping grout and concrete/grout fill at 28 Days shall be 4,000 psi.

## 2.7 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is defined such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.
- B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.
- B. Rough concrete lightly, but not enough to interfere with placement of grout.

- C. Remove foreign materials from metal surfaces in contact with grout.
- D. Align, level, and maintain final positioning of components to be grouted.

### 3.2 GENERAL

- A. CONTRACTOR shall arrange for the manufacturer of prepackaged grouts to provide on-Site technical assistance within 72 hours of request, as part of the WORK.
- B. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by ENGINEER.
- C. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed. Concrete substrate shall not be wet prior to placement of epoxy grouts.
- D. Surface preparation, curing, and protection of cement grout shall be in accordance with Section 03 30 00 – Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.
- E. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.
- F. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.
- G. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

### 3.3 GROUTING PROCEDURES

- A. **General:** Mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.
  - 1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout or other thickness if indicated.
  - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout through a headbox of appropriate size. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against retaining surfaces, and joints shall be sealed as recommended by the grout manufacturer to be liquid-tight. Forms shall be coated as recommended by the grout manufacturer for easy form release. Where this method of placement is not practical or where required by ENGINEER, alternate grouting methods shall be submitted for acceptance by ENGINEER.

3. Concrete equipment pads for equipment bases that will be epoxy-grouted shall be sized so that, when the equipment base is fully grouted, the epoxy grout is stopped not less than 4-inches from the edge of the pad.

#### C. Drilled Anchors and Reinforcing Bars

##### 1. General

- a. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28 Day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the manufacturer's instructions.
- b. CONTRACTOR shall identify position of reinforcing steel and other embedded items prior to drilling holes. Care shall be exercised in coring and drilling to avoid damaging existing reinforcing or embedded items. Notify ENGINEER if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and communications conduit, and piping.

##### 2. Epoxy Adhesive Anchors

- a. Grout shall be proportioned and mixed with automatic equipment.
- b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 8 diameters for threaded rod or 12 diameters for reinforcing or smooth bars.
- c. Holes required for grouting shall be blown or vacuumed clean and are to be free of dust and standing water. Horizontal holes for grouting are to be drilled at a slight downward angle and with the inserted dowel or bolt bent to match.

##### 3. Cement Based Non-Shrink Grout

- a. In places of high temperature or fire hazard, anchor bolts shall be grouted in using cement based non-shrink grout, Class I.
- b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 16 diameters for threaded rod or 24 diameters for reinforcing or smooth bars.
- c. When the bolt diameter is one-inch or less, the hole diameter should be a minimum of 2-inches. When the bolt diameter is greater than one-inch, the hole diameter should be at least twice the bolt diameter.
- d. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.
- e. The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

#### D. Topping Grout and Concrete/Grout Fill

1. Mechanical, electrical, and finish WORK shall be completed prior to placement of topping or concrete/grout fill. To ensure bonding to the base slab, the base slab shall be given an exposed aggregate finish. Alternatively, where accepted by ENGINEER, the base slab shall be given a roughened textured surface by a close-spaced rake while the surface is green. After curing, high pressure washing shall expose the aggregates and produce not less than a 3/16-inch amplitude roughness. Jackhammers or chipping hammers shall not be used.
2. The minimum thickness of grout topping and concrete/grout fill shall be one-inch. Where the finished surface of concrete/grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.
3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry (SSD) condition per the International Concrete Repair Institute (ICRI) -- Technical Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat cement grout shall be broomed into the surface of the slab just before topping or fill placement. The neat cement grout shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill shall be compacted by rolling or thorough tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade. Coat surface with evaporation retardant as needed to prevent plastic shrinkage cracks.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots that shall be immediately eliminated. When the topping or fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.
6. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by ENGINEER, the tank shall be filled with sufficient water to cover the entire floor for 14 days.

### 3.4 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

### 3.5 CURING

- A. Cement based grouts shall be cured per 03 30 00 – Cast-in-Place Concrete and per the manufacturer's recommendations.

- END OF SECTION –



**SECTION 04 22 00**  
**REINFORCED UNIT MASONRY**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section covers reinforced unit masonry and appurtenant work.

**1.2 RELATED WORK**

- A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 20 00 Concrete Reinforcement
3. Section 03 30 00 Cast-in-place Concrete
4. Section 07 21 00 Insulation
5. Section 07 92 00 Joint Sealants
6. Section 09 90 00 Painting and Finishes

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICA CONCRETE INSTITUTE (ACI)

1. ACI SP-66 ACI Detailing Manual
2. TMS 402-16 Building Code Requirements for Masonry Structures
3. TMS-602-16 Specifications for Masonry Structures

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
2. ASTM A 951 Standard Specification for Steel Wire for Masonry Joint Reinforcement
3. ASTM A 1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
4. ASTM C 90 Standard Specification for Load-Bearing Concrete Masonry Units
5. ASTM C 140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
6. ASTM C 144 Standard Specification for Aggregate for Masonry Mortar
7. ASTM C 150 Standard Specification for Portland Cement
8. ASTM C 207 Standard Specification for Hydrated Lime for Masonry Purposes
9. ASTM C 270 Standard Specification for Mortar for Unit Masonry
10. ASTM C 404 Standard Specification for Aggregates for Masonry Grout
11. ASTM C 476 Standard Specification for Grout for Masonry
12. ASTM C 578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
13. ASTM C 652 Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)

- |                 |  |
|-----------------|--|
| 14. ASTM C 1019 | Standard Test Method for Sampling and Testing Grout  |
| 15. ASTM C 1314 | Standard Test Method for Compressive Strength of Masonry Prisms  |
| 16. ASTM C 1384 | Standard Specification for Admixtures for Masonry Mortars  |
| 17. ASTM D 226  | Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing              |
| 18. ASTM D 2000 | Standard Classification System for Rubber Products in Automotive Applications                            |
| 19. ASTM D 2287 | Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds |
| 20. ASTM E 514  | Standard Test Method for Water Penetration and Leakage Through Masonry                                   |
| 21. ASTM E 518  | Standard Test Methods for Flexural Bond Strength of Masonry  |

**D. NATIONAL CONCRETE MASONRY ASSOCIATION (NCMA)**

1. NCMA-TEK 45 Removal of Stains from Concrete Masonry Walls

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements and color samples. Include in the submittal dimensioned drawings for each type of block to be used on the project including, but not limited to, standard field block, lintel block, end block, caps, etc. Submit certificates showing compliance to the specifications for reinforcing steel, manufacturer's literature for anchor ties and any other accessories used, grout and mortar mix design, samples for mortar color selection, and manufacturer's literature for mortar and grout admixtures used along with CONTRACTOR's proposed usage details.
- C. Three sample specimens of the masonry units proposed for incorporation into the project shall be submitted to ENGINEER.
- D. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars, complying with ACI SP-66. Show bar schedules, diagrams of bent bars, stirrup, spacing, lateral ties, and other components required for fabrication and placement of masonry reinforcement.
- E. Submit product data for premolded control joint strips and joint sealant.
- F. A minimum 4-ft square free-standing sample panel shall be prepared for approval before starting masonry work. The panel shall remain at the site for reference until masonry work is completed.

**1.5 QUALITY ASSURANCE**

- A. Masonry units shall be sampled and tested in accordance with ASTM C 140.

- B. CONTRACTOR shall have mortar and grout tested to assure compliance with the Specifications and the governing codes by a testing laboratory approved by ENGINEER. The test reports shall be submitted to ENGINEER.
1. Tests shall be taken at the following times:
    - a. At commencement of masonry work, at least 2 samples each of mortar and grout shall be taken on 3 successive days.
    - b. At any change in materials or job conditions, at least 2 samples of each modified material, grout and mortar shall be tested.
    - c. Make four (4) random tests each of mortar and grout. The random test samples shall be taken when requested by ENGINEER.
    - d. The costs of tests shall be paid by CONTRACTOR as part of the work. The costs of additional tests, when required to verify compliance when requested by OWNER or ENGINEER, will be paid by OWNER. When tests do not verify compliance, the cost of additional tests shall be paid by CONTRACTOR.
  2. Samples shall be stored in a moist environment until tested, unless directed otherwise by ENGINEER or the testing laboratory. Testing for mortar shall be in accordance with ASTM C 270. Testing for grout shall be in accordance with ASTM C 1019.
- C. CONTRACTOR shall test the masonry units to assure compliance with the specifications and governing codes. Testing will be by a laboratory approved by ENGINEER.
1. Testing will be made of the following items:
    - a. At the time of the construction of the sample panel, at least 3 masonry units shall be tested for each type of block, except separate tests are not required for block which only varies by texture.
    - b. At any change in materials during construction, at least 3 masonry units shall be tested.
    - c. Additional sets of at least 3 masonry units shall be tested whenever, in the judgment of ENGINEER, additional tests are necessary to determine the quality of the material.
    - d. CONTRACTOR shall submit a letter of certification from the masonry unit supplier at the time of, or prior to, delivery of the materials to the site that the materials used in construction are representative of the materials used to construct the prisms.
  2. The masonry units shall be sampled and tested in accordance with ASTM C 140.
- D. Whenever required under the provisions of the Building Code, the work shall be subject to inspection by a Special Inspector selected by ENGINEER and approved by the local building code representative having jurisdiction. Costs of such inspections will be paid by OWNER. The Special Inspector will work under the supervision of ENGINEER. Special Inspection will be in accordance with the Construction Drawings.
- E. Cold weather construction shall be per ACI 530.1, IBC Section 2104.3, and the local code requirements, whichever is more stringent.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. CONTRACTOR shall be responsible to deliver, handle, and store masonry units by means which will prevent mechanical damage and deterioration due to moisture, temperature changes, and corrosion. CONTRACTOR shall provide protection which will

limit moisture absorption of concrete masonry units to the maximum percentage specified for Type I units for the average relative humidity at the project site, as reported by the nearest National Weather Service station.

- B. Cementitious materials shall be stored off the ground and protected from moisture.
- C. Aggregates shall be stored in a manner which will preserve grading characteristics.
- D. Masonry accessories shall be stored to prevent corrosion, dirt accumulation, and other deterioration.

## **1.7 PROJECT CONDITIONS**

- A. Cold Weather Protection: Do not lay masonry units when outside air temperature is below 40 degrees F.
  - 1. Grouted construction: On any day when the minimum anticipated nighttime temperature is 32 degrees F or less, in addition to complying with general procedures above, grout materials shall be heated to 90 degrees F to produce an in-place grout temperature of not less than 70 degrees F at end of work day. Protective blankets or enclosures shall remain in place for not less than 48 hours after placement of masonry units.
  - 2. Water: Water for mortar or grout shall not be heated to more than 160 degrees F.
- B. Hot-Weather Protection: Cover or shade masonry units and mortar materials and use cool water for mortar whenever ambient air temperature is 90 degrees F or greater. At air temperatures of 85 degrees F or above, if relative humidity is less than 30 percent or wind is in excess of 15 miles per hour, provide protection by immediately covering newly constructed walls by providing windbreaks, or by using fog spray to reduce rate of evaporation.

## **1.8 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for reinforced unit masonry. Full compensation for all reinforced unit masonry shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which reinforced unit masonry relates.

## **PART 2 PRODUCTS**

### **2.1 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards for types required, and as follows:
  - 1. Unit, Grade and Type: Masonry units shall conform to the requirements of the following table:

Unit	ASTM	Grade	Type	Minimum Net Area <sup>(1)</sup> Compressive Strength (psi)
Concrete Masonry Unit (CMU)	C 90	Normal	Hollow	2,000
Note: (1) Average of 3 units				

2. Size: The size of masonry units shall be as indicated on the Contract Drawings. Special shapes and sizes shall be provided as required, whether or not specifically indicated on the Contract Drawings as special.
3. Surfaces: Special surface texture or architectural faces shall be provided where indicated on the Contract Drawings.
4. Color: Where the finished surface will be visible, masonry units shall have colors as indicated on the Contract Drawings. Where colors are not specified, OWNER shall determine colors to be provided.

## 2.2 MATERIALS

- A. Portland Cement: ASTM C 150, Type II or IIA.
  1. Type III may be substituted during cold-weather construction.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate for Mortar: Sand conforming to ASTM C 144.
- D. Aggregate for Grout: ASTM C 404.
- E. Admixture for grout, if used, shall be **Sika Grout Aid by Sika Corp.**, or approved equal.
- F. Water: Clean and potable.
- G. Masonry cleaner shall be a non-acidic cleaner, **SafEtch by Prosoco, Inc.**, or approved equal.
- H. Accelerating Admixture: Non-chloride admixture for use in mortar mixes during cold weather, proportioned and mixed to comply with directions of manufacturer.
  1. Products: The following products, provided they comply with requirements of ASTM C 1384 and the contract documents, will be among those considered acceptable.
    - a. MORSET by Grace Construction Products
    - b. or approved equal
- I. Water-repellant and efflorescence control admixture.
  1. All exterior masonry units shall utilize a water-repellant and efflorescence control admixture as recommended by the manufacturer to obtain ASTM E 514 test extended to 72 hours, class E rating.

2. Admixtures shall be MasterPel 240 (Rheopel Plus) by BASF, Eucon Blocktite by Euclid Chemical Company, or approved equal.

J. Integral water repellent admixture is required for mortar for exterior masonry units and shall be **MasterPel 240MA (Rheopel Plus Mortar Admixture) by BASF, Blocktite Mortar Admixture by Euclid Chemical Company**, or approved equal.

## **2.3 REINFORCEMENT AND ANCHORAGE**

A. Reinforcing Bars shall be in accordance with Section 03 20 00 – Concrete Reinforcement.

B. Joint Reinforcement and Anchorage Materials: shall comply with ASTM A 951 and the following general requirements for materials required in joint reinforcement and anchorage devices.

1. Steel wire: ASTM A 1064.

a. Zinc coating: ASTM A 641 Class 1.

b. Application: Use at interior locations.

## **2.4 MISCELLANEOUS MASONRY ACCESSORIES**

A. Premolded Control Joints Strips: Joints designed to fit standard sash block and to maintain lateral stability in masonry wall, of size and configuration indicated or as required for conditions, and as follows:

1. Styrene-butadiene rubber compound complying with ASTM D 2000, 2AA-805, or

2. Polyvinyl chloride complying with ASTM D 2287, Type PVC 654-4.

B. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type 1 (No. 15 asphalt).

C. Joint Sealant: Provide joint sealants in accordance with Section 07 92 00.

## **2.5 MORTAR AND GROUT MIXES**

A. General: Do not use admixtures unless indicated and approved by ENGINEER. Do not use calcium chloride in mortar or grout mixture.

B. Mixing: Combine and thoroughly mix ingredients in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

C. Mortar for Unit Masonry: Comply with ASTM C 270 and IBC Section 2103.7, Proportion Specification, for types of mortar required, unless otherwise indicated.

1. Limit cementitious materials in mortar to Portland cement and lime.

2. Use Type S mortar for reinforced masonry.

3. Mortar for use with colored masonry units shall have the integral color as approved by OWNER.

D. Grout: Comply with ASTM C 476 and IBC 2103.10 for grout used in construction of unit masonry elements. Use grout of consistency indicated or as required at time of

placement to fill completely all spaces intended to receive grout. Compressive strength: 2500 psi @ 28 days.

1. Use fine grout in spaces less than 2 inches in least horizontal dimension, unless otherwise indicated.
2. Use coarse grout in spaces 2 inches or more in least horizontal dimension, unless otherwise indicated.

## **2.6 MASONRY SEALERS**

- A. Sealers shall be as noted in Section 09 90 00 - Painting and Finishes.

## **PART 3 EXECUTION**

### **3.1 GENERAL INSTALLATION PROCEDURES**

- A. Concrete Masonry Units: Do not wet concrete masonry units prior to laying.
- B. Measurements for mortar and grout shall be accurately made. Shovel measurements are not acceptable. Mortar proportions shall be accurately controlled and maintained.
- C. Reinforcing: Before placing masonry reinforcing, remove loose rust, dirt, and other coatings.
- D. Masonry Thickness: Build masonry elements to full thickness shown.
  1. Build single-wythe walls to actual thickness of masonry units, using units of size indicated.
- E. Chases and Recesses: Build masonry to accommodate the work of other trades, including chases and recesses as shown or required. Provide not less than 8 inches of masonry between jambs of openings and chases and recesses.
- F. Leave openings for equipment to be installed in masonry. After installation of equipment, complete masonry work to match work immediately adjacent to opening.
- G. Cutting Masonry Units: Use motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use dry cutting saws to cut concrete masonry units.
- H. Add insulation to open cells if required on the Contract Drawings. See Section 07 21 00 - Insulation.
- I. Work shall be performed in accordance with TMS 402-16 and TMS 602-16, the latest edition of the IBC, and local governing codes for reinforced concrete hollow-unit masonry.
- J. CONTRACTOR shall set or embed anchors, bolts, reflets, sleeves, conduits, and other items as required prior to placing grout in cells.

### **3.2 CONSTRUCTION TOLERANCES**

- A. Variation from Plumb: Do not exceed the following construction tolerances in vertical elements, including surfaces of walls, columns, and arises:
  - 1. 1/4 inch to 10 feet
  - 2. 3/8 inch to one story height, or 20 feet, whichever is less, except 1/4 inch for external corners, expansion joints, and other highly conspicuous vertical elements
  - 3. 1/2 inch for 40 feet or more
  - 4. Plus or minus 1/4 inch in 10 feet, 1/2 inch maximum, for vertical alignment of head joints.
- B. Variation from Level: Do not exceed the following construction tolerances for bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal elements:
  - 1. 1/4 inch in one bay or in 20 feet maximum
  - 2. 1/2 inch in 40 feet or more
- C. Variation from Plan Lines: Do not exceed the following horizontal construction tolerances for related portions of columns, walls, and partitions:
  - 1. 3/8 inch in any bay of 16 feet maximum
  - 2. 1/2 inch in 32 feet or more
- D. Variation in Cross Section: Do not exceed the following masonry elements:
  - 1. Minus 1/4 inch
  - 2. Plus 1/2 inch
- E. Variation in Mortar Joint Thickness: Do not exceed the following construction tolerances for thickness of mortar joints:
  - 1. Bed joints: Plus or minus 1/8 inch
  - 2. Head joints: Plus or minus 1/8 inch

### **3.3 MASONRY CONSTRUCTION - GENERAL**

- A. Layout: Lay out masonry for accurate pattern bond, for uniform joint widths, and for accurate location of specific features before beginning actual construction. Avoid use of masonry units of less than 1/2 size. Do not use units with less than nominal 4 inch horizontal face dimensions at corners and jambs.
- B. Pattern Bond: Lay exposed masonry in 1/2 running bond with vertical joints in each course centered on units in course above and below except where other bonds are indicated at special features.
  - 1. Lay concealed masonry with all units in a wythe in running bond.
  - 2. Bond and interlock each course of each wythe at corners.
- C. Reinforced Concrete Unit Masonry: Maintain vertical continuity of core or cell cavities. Keep cavities clear of mortar, including bed area of first course, to provide minimum



clear dimension indicated, to provide minimum clearance and grout coverage for vertical reinforcement bars, and to provide direct grout contact with supporting surfaces.

- D. Stopping and Resuming Work: Lay masonry in proper sequence to avoid toothing. Rack walls back in each course at end of each day. Before resuming, clean exposed surfaces and remove loose masonry units and mortar.
- E. Built-in Work: As work progresses, build in items indicated for installation in masonry, filling around built-in items solidly with masonry.
  - 1. Fill spaces between metal frames and masonry elements solidly with mortar, unless otherwise indicated.
- F. Install lintels of types indicated at all openings.
  - 1. Bearing: Provide not less than 8 inches of bearing at each jamb unless otherwise indicated.
  - 2. Reinforcement: At masonry openings greater than one foot in width, install horizontal joint reinforcement in 2 horizontal joints approximately 8 inches apart immediately above lintel and immediately below sill. Extend reinforcement which is in addition to required continuous joint reinforcement not less than 24 inches beyond jambs of the opening, except at control joints.
- G. Formwork: Provide temporary formwork and shores as required for temporary support of reinforced masonry elements. Construct formwork to shape line, and dimensions shown. Make sufficiently tight to avoid leakage of mortar and grout.
  - 1. Brace, tie, and support as required to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary loads that may be placed on them during construction.

### **3.4 MORTAR BEDDING AND JOINTING**

- A. Lay hollow masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be grouted or filled with concrete.
- B. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. Except as otherwise indicated, maintain joint widths of 3/8 inch.
- C. Cut joints flush for masonry walls which are concealed or covered by other materials, unless otherwise indicated.
- D. Tool exposed joints slightly concave, using a jointer larger than joint thickness unless otherwise indicated.
- E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners of jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

### **3.5 INSTALLATION OF REINFORCEMENT**

- A. Preparation: Do not use reinforcement bars with kinks or bends not shown on Contract Drawings or final shop drawings. Do not use bars with cross section reduced due to excessive rusting and other causes.
- B. Placement: Position reinforcement bars accurately at spacings indicated. Support and secure vertical bars against displacement. Horizontal bars may be placed as the work progresses. Provide not less than the greater of either the bar diameter or 1 inch clear between bars. For columns, piers, and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater.
- C. Splicing: Provide lapped splices at locations shown; do not splice at other points or by other methods, unless approved by ENGINEER. Provide not less than minimum lap indicated, or as required by governing code.

### **3.6 GROUTING**

- A. Grouting Technique:
  - 1. Provide minimum clear dimension of 2 inches and minimum clear area of 8 square inches in vertical cores to be grouted. Place vertical reinforcement prior to laying concrete masonry units, extending above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters or 10 feet, whichever is less.
  - 2. Grout shall be placed in all open areas of the masonry block as specified herein.
  - 3. Lay masonry units to maximum pour height, not to exceed 4 feet.
  - 4. Pour grout using chute or container with spout. Vibrate grout during placement. Place grout continuously; do not interrupt pouring operation for more than 1 hour. Terminate pour 1-1/2 inches below top of highest course in pour, except at tops of walls.
  - 5. Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beams.

### **3.7 REPAIR AND POINTING**

- A. Repair: Remove and replace masonry units which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units, and install in fresh mortar or grout pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of mortar joints, enlarge any holes or voids except weep holes and completely fill with mortar. Point up all joints, including corners, openings, and adjacent work, to provide a neat and uniform appearance.

### **3.8 CLEANING AND PROTECTION**

- A. Clean masonry as follows after mortar is thoroughly set and cured:

1. Remove large mortar particles by hand, using wooden paddles and nonmetallic scrape hoes or chisels.
  2. Test cleaning methods on sample wall panel, leaving half of panel uncleaned for comparison.
  3. Clean concrete unit masonry to comply with directions of masonry manufacturer and as recommended by NCMA in Tek Bulletin No. 45.
- B. Protection: CONTRACTOR shall protect all masonry until such time as the Work is completed and accepted by ENGINEER.

### **3.9 FINISH**

- A. Block shall be finished as per Section 09 90 00 - Painting and Finishes.

- END OF SECTION -

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**SECTION 05 45 00**  
**MECHANICAL METAL SUPPORTS (PIPE SUPPORTS)**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section covers materials and installation of mechanical metal supports, pipe supports, hangers, guides, anchors and appurtenances as specified and indicated.
- B. CONTRACTOR shall provide mechanical metal supports in accordance with this Section whether shown on the Contract Drawings or not.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:

- |                        |                               |
|------------------------|-------------------------------|
| 1. Section 01 33 00    | Submittal Procedures          |
| 2. Section 05 50 00    | Miscellaneous Metals          |
| 3. Section 09 90 00    | Painting and Finishes         |
| 4. Section 33 05 03    | Copper Pipe                   |
| 5. Section 33 05 05    | Ductile Iron Pipe             |
| 6. Section 33 05 07.1  | PVC Pressure Pipe (ASMT 1785) |
| 7. Section 33 12 00    | Mechanical Appurtenances      |
| 8. Section 40 05 13.13 | Steel Process Piping          |

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (MSS)
  - 1. MSS SP-58 Pipe Hangers and Supports – Materials Design and Manufacture
  - 2. MSS SP-69 Pipe Hangers and Supports – Selection and Application
  - 3. MSS SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices
  - 4. MSS SP-127 Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
- C. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
  - 1. ASME B 31.1 Power Piping
- D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 36 Standard Specification for Carbon Structural Steel
  - 2. ASTM A 47 Standard Specification for Ferritic Malleable Iron Castings
  - 3. ASTM A 48 Standard Specification for Gray Iron Castings
  - 4. ASTM A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 5. ASTM A 153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and

- |               |   |
|---------------|---|
| 6. ASTM A 575 | Steel Hardware<br>Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades |
| 7. ASTM A 576 | Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality                 |

## **1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. CONTRACTOR shall submit complete shop drawings of mechanical supports, pipe supports, hangers and guides. Provide scaled shop drawings showing locations of the supports and detailed drawings for each support. Identify each type of hanger or support by the manufacturer's part number of figure on the drawing.
- C. Provide installation drawings and manufacturer's catalog information on each type of hanger and support.
- D. Provide structural calculations for special supports and anchors, stamped and signed by a professional engineer registered in the State of Utah.

## **PART 2 MATERIALS**

### **2.1 GENERAL**

- A. All pipe hanger and supports shall be manufactured to comply with MSS-SP-58, MSS-SP-569, MSS-SP-89 except as modified herein. Where applicable, design and manufacture must also conform to ANSI/ASME B31.1. Supports for plumbing or fire piping shall be in accordance with the latest edition of the applicable plumbing or fire code and the requirements of the local jurisdiction.
- B. Hangers, supports, anchors and restraints must be designed in accordance with MSS-SP-127 to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment. Piping supports and equipment must be considered as a total system and appropriate balance calculations made to determine load forces at critical stress points. Loading conditions to be considered may include, but are not limited to:
  - 1. The total load of pipe, fittings, valves, insulation and any expected contents of the pipe.
  - 2. Thermal expansion and contraction
  - 3. Stress from cycling of equipment or process.
  - 4. Vibration transmitted to or from equipment or terminal connection.
  - 5. Wind, snow or ice loading on outdoor piping
  - 6. Loading due to seismic forces
- C. Static and dynamic forces at points of attachments must be considered to help ensure structural integrity of buildings or equipment. Hanger and supports must be selected so as to minimize the effect of piping system loading on the structure.
- D. In general, piping shall be supported from structural members, such as walls, beams, columns and slabs, using approved structural attachments. In situations where

approved attachments cannot be used, alternative attachments or substructure assemblies must receive approval by ENGINEER prior to installation. Prior approval by ENGINEER must be given before any cutting or drilling of building structural steel. Damage to the structure through welding, cutting or drilling will not be permitted if it reduces the structures strength below the established safety factor for the structure. Any additional structural steel required to properly support piping or equipment shall be furnished and installed by CONTRACTOR at no additional cost to OWNER.

## **2.2 SUPPORT MATERIALS**

- A. Pipe supports, hangers, guides, etc. shall be hot-dip galvanized carbon steel, unless noted otherwise on the Drawings. Steel shall be in accordance with ASTM A 36, ASTM A 575, or ASTM A 576. Hot-dip galvanizing shall be in accordance with ASTM A 123 or ASTM A 153. Bases, rollers, and anchors shall be steel as described above or may be cast iron conforming to ASTM A 48. Pipe clamps shall be steel as described above or may be malleable iron conforming to ASTM A 47.
- B. Submerged supports, as well as piping in hydraulic structures within 24 inches of the high water level, shall have supports, including hardware and anchors constructed of Type 316 stainless steel, unless noted otherwise on the Drawings.
- C. Piping in chemical or corrosive areas shall have supports, including hardware and anchors constructed of Type 316 stainless steel or fiberglass reinforced plastic (FRP), unless noted otherwise on the Contract Drawings.
- D. Supports fabricated from other materials specified on the Drawings shall have a protective coating in accordance with the requirements of Section 09 90 00 – Painting and Finishes.

## **2.3 FLOOR MOUNTED SUPPORTS**

- A. Floor mounted pipe supports shall be the adjustable saddle support with stanchion, base and U-bolt or adjustable flange support type with stanchion and base. Pipe supports with stanchion and base plate shall be sized for the pipe or mechanical appurtenance it supports. All pipe supports shall have a 1-inch-high grouted pad to be used as a leveling base. Pipe supports shall be secured to the floor. An EPDM Rubber insulation pad shall be provided between the pipe and the U-Bolt.

## **2.4 SPRING-TYPE HANGERS**

- A. Spring-type hangers shall be provided for piping subject to vibration or vertical expansion/contraction such as engine exhaust piping. Design the spring-type hangers per the manufacturer's recommendations.

## **2.5 CONCENTRATED LOADS**

- A. Concentrated loads, such as meters, valves, and equipment, on PVC piping systems shall have supports on each side of the concentrated load.

## **2.6 CONCRETE ANCHORS**

- A. Anchors shall be in accordance with Section 05 50 00 – Miscellaneous Metals.

## 2.7 MANUFACTURERS

- A. Mechanical Metal Support (pipe support) manufacturers shall be **Anvil International Inc., B-Line by Eaton (Cooper Industries), Utility Coatings & Fabrication, Piping Technology & Products, Inc. (PT&P)**, or approved equal. To be considered an approved equal, materials must be of similar diameter, thickness, and strength to the product specified.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. Mechanical metal supports, pipe supports, hangers, guides, etc. shall be installed per the manufacturer's instructions and ASME B31.1 – Power Piping.
- B. Pipe supports shall be positioned in order to produce an orderly, neat piping system. Hanger rods shall be vertical without offsets.
- C. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting as close to ceilings or roods as possible and without interference with other work.
- D. Hangers shall be installed in a manner to prevent obstructing ladders, manhole covers, and access hatches.
- E. Set embedded inserts accurately in position and support them rigidly before concrete is placed and prevent displacement during and after placement of concrete.
- F. Provide separate hangers or supports at valves, meters, elbows, tees, and other equipment. Provide separate hangers on each both sides of each non-rigid joint or flexible coupling.
- G. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, or other pipe to which the pipe is connected.
- H. Hangers and supports for rigid plastic pipe shall be provided with a support shield to spread the load bearing surface.
- I. Use of wire hangers, perforated strap, hanging from unreinforced metal deck and cellular roof deck are not permitted.
- J. Repair or replace metal items damaged during installation. Follow the manufacturer's procedures for repairing damaged surfaces.
- K. Galvanizing Field Repairs
  - 1. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.
  - 2. The coating shall be applied to at least 3 mils dry film thickness and shall be **Zinc-Clad XI by Sherwin-Williams, Galvax by Alvin Products, Galvite by ZRC Worldwide**, or approved equal.



### 3.2 SUPPORT LOCATION AND SPACING

- A. Supports for horizontal piping shall be spaced to prevent excessive sag, bending and stresses in the piping. Spacing shall not exceed the maximum indicated spans.
- B. Maximum spans indicated in the tables below are for ambient temperatures or the temperatures listed for the materials and pipe wall thicknesses shown. Adjust the span spacing for different temperatures and/or pipe wall thicknesses per the manufacturer's recommendations.
- C. Install pipe supports on horizontal and vertical runs at the spacing shown or detailed on the Contract Drawings. If no spacing or rod sizes are given on the Contract Drawings or in the specifications for a particular piping system, use the following tables or the recommendations of the support or pipe manufacturer.

1. Support Spacing for Steel Pipe (Section 40 05 13.13 – Steel Process Piping) Schedule 40 and Schedule 80:

Pipe Size (inches)	Maximum Span Water Service (feet)	Maximum Span Vapor Service (feet)	Minimum Hanger Rod Size (inches)
3/8 and smaller	4	5	3/8
1/2 through 1	6	8	3/8
1-1/4 through 2	8	10	3/8
2-1/2 through 3	10	14	1/2
3-1/2 through 4	10	15	5/8
6	12	20	3/4
8	12	24	3/4
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.			

2. Support Spacing for Copper Pipe (Section 33 05 03 – Copper Pipe) per MSS-SP-69, Table 3:

Pipe Size (inches)	Maximum Span Water Service (feet)	Maximum Span Vapor Service (feet)	Minimum Rod Size (inches)
1/2	5	6	3/8
3/4	5	7	3/8
1	6	8	3/8
1-1/4	7	9	3/8
1-1/2	8	10	3/8
2	8	11	3/8
2-1/2	9	12	1/2
3	10	14	1/2
3-1/2	11	15	1/2
4	12	16	5/8
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.			

3. Support Spacing for PVC Pipe (Section 33 05 07.1 – Polyvinyl Chloride Pipe) Schedule 40 and Schedule 80. The table below is meant as a general guideline and it is recommended that the pipe manufacturer be consulted for specific spacing recommendations relating to their pipe, load conditions, operating temperatures, and service conditions.

Pipe Size (inches)	Maximum Span Schedule 40 (feet)				Maximum Span Schedule 80 (feet)			
	60°F	80°F	100°F	120°F	60°F	80°F	100°F	120°F
1/2	4.5	4.5	4	2.5	5	4.5	4.5	3
3/4	5	4.5	4	2.5	5.5	5	4.5	3
1	5.5	5	4.5	3	6	5.5	5	3.5
1-1/4	5.5	5.5	5	3	6	6	5.5	3.5
1-1/2	6	5.5	5	3.5	6.5	6	5.5	3.5
2	6	5.5	5	3.5	7	6.5	6	4
2-1/2	7	6.5	6	4	7.5	7.5	6.5	4.5
3	7	7	6	4	8	7.5	7	4.5
4	7.5	7	6.5	4.5	9	8.5	7.5	5
6	8.5	8	7.5	5	10	9.5	9	6
8	9	8.5	8	5	11	10.5	9.5	6.5
10	10	9	8.5	5.5	12	11	10	7
12	11.5	10.5	9.5	6.5	13	12	10.5	7.5
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.								
Data taken from Anvil International, Inc. Catalog PH-2006, page PH-213 and is based on continuous span and for un-insulated line carrying fluids of specific gravity up to 1.00.								

4. Supports for Ductile Iron Pipe (Section 33 05 05 – Ductile Iron Pipe) should be installed in locations shown on the Drawings with a minimum of one support per 20-foot length of pipe. If longer spans are required, the supports should be designed in accordance with DIPRA – Design of Ductile Iron Pipe on Supports and the pipe manufacturer's recommendations. Supports should be cradle type with a saddle angle of 120 degrees. The table below shows the recommended maximum spans per US Pipe – Long Span and Bridge Crossing Pipe guidelines.

Pipe Size (inches)	Maximum Span Water Service (feet)
6	28
8, 10	30
12, 14	35
16, 18	42
20 to 64	45
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.	

5. Support Spacing for ABS Pipe (Section 33 05 01 – ABS Pipe) Schedule 40. The

table below is meant as a general guideline and it is recommended that the pipe manufacturer be consulted for specific spacing recommendations relating to their pipe, load conditions, operating temperatures, and service conditions.

Pipe Size (inches)	Maximum Span Schedule 40 (feet)				
	60°F	80°F	100°F	120°F	140°F
1-1/2	6	6	5.5	3.5	3
2	6	6	5.5	3.5	3
3	7	7	7	4	3.5
4	7.5	7.5	7	4.5	4
6	8.5	8.5	8	5	4.5
Note: Plumbing code may require a maximum horizontal spacing of 4 feet for all pipe sizes. Verify requirement with the local governing agency.					

6. Support spacing for other pipe materials shall be based on recommendations from the pipe manufacturer.
7. Provide sway bracing for hangers where shown on the Drawings. If no bracing is shown, provide bracing at 10 foot maximum center-to-center intervals.

- END OF SECTION -

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**SECTION 05 50 00**  
**MISCELLANEOUS SPECIALTIES**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section covers materials, fabrication, and installation of miscellaneous metals and appurtenances as specified and indicated.

**1.2 RELATED SPECIFICATIONS**

- A. Fabrication and erection of the platforms, ladders and stairs shall be in accordance with the Specification for the Design, Fabrication and Creation of Structural Steel for Buildings of the latest edition of the A.I.S.C. Manual, and Section 1910.27 of the latest edition of the OSHA standards, except as specified herein.

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

1. Manual of Steel Construction

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |               |  |
|---------------|--|
| 1. ASTM A 36  | Standard Specification for Carbon Structural Steel   |
| 2. ASTM A 53  | Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless     |
| 3. ASTM A 123 | Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.          |
| 4. ASMT A 153 | Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware                       |
| 5. ASTM A 276 | Standard Specification for Stainless Steel Bars and Shapes   |
| 6. ASTM A 307 | Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength |
| 7. ASTM A 615 | Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement         |
| 8. ASTM F 593 | Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs                        |
| 9. ASTM F 594 | Standard Specification for Stainless Steel Nuts  |

D. NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

**1.4 RELATED WORK**

- A. Related work in other Sections includes but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes

## **1.5 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. CONTRACTOR shall submit complete shop drawings of fabricated items, such as vents, ladders, stairs, platforms, beams, pipe supports, and miscellaneous metals for approval to Engineer.
- C. Shop drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the work.
- D. Shop drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.
- E. Submit manufacturer's catalog data and dimensional drawings for lifting eyebolts and inserts; ladder safety posts, manhole covers and frames, and anchor bolts.
- F. Submit ICC ES Evaluation Reports for adhesive and wedge anchors and installer qualifications and procedures.

## **PART 2 MATERIALS**

### **2.1 CARBON STEEL**

- A. Materials for bolted or welded steel construction shall conform to ASTM A 36.

### **2.2 STAINLESS STEEL**

- A. All bolts, expansion bolts, nuts, washers, and expansion sleeve inserts used to attach metal supports shall be stainless steel Type 316.
- B. All interior tank ladders, wall conduits, louvers, and other items required shall be stainless steel unless noted otherwise.

### **2.3 HOT-DIPPED GALVANIZED**

- A. All vents, stairs, vault ladders, handrail, stringers, beams and miscellaneous items shall be galvanized (zinc coated) unless noted otherwise.
- B. Zinc coating for plates, bolts, anchor bolts, and threaded parts shall in in accordance with ASTM A 153. Structural steel shall be zinc coated in accordance with ASTM A 123.

### **2.4 BOLTS**

- A. Steel anchor and connection bolts for non-corrosive service shall conform to ASTM A 307, Grade A or B, unless otherwise noted. Bolts shall be hot-dip galvanized and provided with self-locking nuts or lock washers and plain nuts.

- B. Steel anchor and connection bolts for corrosive service shall be fabricated from stainless steel, unless indicated otherwise in the specifications or on the Contract Drawings. Corrosive service locations are as listed below.
  - 1. Buried locations
  - 2. Submerged locations
  - 3. Locations subject to occasional flooding
  - 4. Inside hydraulic structures
  - 5. Chemical handling areas
  - 6. Inside buried manholes, vaults, and structures that do not have a gravity drain or sump pump
  - 7. Inside trenches, containment walls, and curbed areas.
- C. The nuts shall be capable of developing the full strength of the bolts. Bolts and cap screws shall have hexagon heads and nuts shall be heavy hexagon series. Bolts and nuts shall be installed with washers from material matching the base material of bolts. Lock washers fabricated from the material matching the bolts shall be installed where indicated.
- D. The length of the bolts shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

## 2.5 LIFTING EYEBOLTS

- A. Locate eyebolts and inserts over the centerline of the piping at locations shown on the Drawings. Eyebolts and inserts shall have a minimum safety factor of 3 and be rated for a working load of 3,000 pounds.
- B. Provide inserts of the ferrule wing nut design with threads to match the eyebolts. Cast inserts in the roof slab of the vault at the locations identified on the Drawings.

## 2.6 THREADED INSERTS

- A. Threaded inserts shall be of ductile iron construction with standard N.C. threads. Inserts shall be cast-in-place at the locations shown on the Drawings. Inserts shall be fabricated by **Meadow Burke**, or approved equal.

## 2.7 ADHESIVE ANCHORS

- A. Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered without an ICC ES Report verifying strength and material equivalency. Anchors used inside potable water reservoirs shall be ANSI/NSF 61 certified.
- B. Adhesive anchors shall be a two component system consisting of an all threaded anchor rod with nut and washer, and the adhesive capsule. Anchor rods shall be Type 304 stainless steel conforming to ASTM F 593 with nuts conforming to ASTM F 594. The adhesive capsules shall contain a polyvinyl or urethane methacrylate-based resin and accelerator within a sealed dual chamber foil capsule. Adhesive anchors shall be **Hilti HVA Capsule Adhesive Anchoring System**, or approved equal.

## 2.8 WEDGE ANCHORS

- A. Wedge type anchors shall be used only where indicated on the Contract Drawings. Wedge anchors shall be a stud type expansion anchor, torque controlled, with impact section to prevent thread damage. Stud and wedge shall be Type 304 or Type 316 stainless steel conforming to ASTM A 276. Nut shall be Type 304 or Type 316 stainless steel conforming to ASTM F 594 with washer of similar material. Wedge anchor bolts shall be **Hilti Kwik Bolt 3**, or approved equal. Anchors installed in non-submerged or non-corrosive environments may be carbon steel and be **Simpson Strong-Tie Strong Bolt**, or approved equal.

## 2.9 STEEL PIPE

- A. Pipe for guard posts shall be Schedule 40 and pipe for vault vents shall be Schedule 10 conforming to ASTM A 53, unless noted otherwise on the Drawings, and shall be hot-dip galvanized.

## 2.10 COVERS AND FRAMES

- A. Manhole covers and frames shall be cast iron and designed for AASHTO HS-20 loading, unless otherwise indicated. Castings shall be smooth, clean and free from blisters, blowholes, and shrinkage. Covers shall seat firmly into the frames without rocking. Covers and frames shall fit together evenly such that the cover fits flush with the surrounding finished surface.

## 2.11 POLYPROPYLENE STEPS

- A. Polypropylene steps shall have a 1/2-inch ASTM A 615 grade 60 steel reinforcement rod encased in polypropylene copolymer plastic. Steps shall have a tread width of 14-inches nominal.
- B. Steps shall be manufactured by **American Step Company, Inc., M.A. Industries, D & L Supply No. F-1981**, or approved equal.

## 2.12 GRATING

- A. Grating shall be supported around all sides of an opening with support members. Unless otherwise indicated, grating supported on concrete shall have embedded angles that match the grating material. Grating shall be serrated bar grating, unless noted otherwise on the Drawings.
- B. The grating shall be completely banded at edges and cutouts and the banding shall be welded to each cut bearing bar. The banding material and cross-section shall be the same as the bearing bars.
- C. Grating pieces shall be fastened to each support at a minimum of 2 locations.
- D. Grating deflection shall not exceed 1/4 inch or the span divided by 180, whichever is less.
- E. For standard duty grating, the loading to be used for determining stresses and deflections shall be the uniform load of the adjacent floor or 100 psf, whichever is



greater, or a concentrated load of 1000 pounds. For heavy duty grating the loading used shall be in accordance with AASHTO HS-20.

- F. Standard duty grating shall be fabricated from steel and hot-dip galvanized, unless noted otherwise. Standard duty grating that will be submerged, partially submerged, or in a corrosive environment shall be fabricated entirely of Type 316 stainless steel. No single piece of standard duty grating shall weigh more than 80 pounds, unless noted otherwise on the Drawings. All crossbars shall be welded into position.
- G. Heavy duty grating shall be fabricated from welded steel and hot-dip galvanized after fabrication. All crossbars shall be welded into position.
- H. Bar dimensions shall be 1-1/4 inch by 3/16 inch, minimum and shall be manufactured by **McNICHOLS, AMICO, Robertsons Grating Products**, or approved equal.

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- A. Except as otherwise shown, the design, fabrication, and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction".
- B. Install miscellaneous specialties as indicated on the drawings or as recommended by the manufacturer.
- C. Store materials above ground on platforms, skids or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.
- D. Clean surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign matter before placing concrete.
- E. Set embedded metalwork accurately in position and support it rigidly before concrete is placed and prevent displacement during and after placement of concrete.
- F. Repair or replace metal items damaged during installation. Follow the manufacturer's procedures for repairing damaged surfaces.
- G. Welding shall be performed by metal-arc method or shielded metal arc method as per the American Welding Society's (AWS) "Welding Handbook". During welding component parts shall be adequately clamped or supported. Avoid irregular surface, non-uniform bead pattern, and high crown. Upon completion of welding, remove weld splatter, flux, slag, and burrs. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.
- H. Adhesive Anchors. Do not install anchors until the concrete has reached the required 28-day compressive strength. Drill hole in concrete by means of a percussion hammer drill. Hole shall be roughened with a brush on a power drill and then cleaned and dried. Install anchor in accordance with the manufacturer's instructions. Do not load the anchor until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

- I. Wedge Anchors. Do not install anchors until the concrete has reached the required 28-day compressive strength. Drill hole in concrete by means of a percussion hammer drill. Hole shall be roughened with a brush on a power drill and then cleaned and dried. Install anchor in accordance with the manufacturer's instructions.
- J. Galvanizing Field Repairs:
  1. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.
  2. The coating shall be applied to at least 3 mils dry film thickness and shall be **Zinc-Clad XI by Sherwin-Williams, Galvax by Alvin Products, Galvite by ZRC Worldwide**, or approved equal.

- END OF SECTION -

## **SECTION 06 10 00**

### **ROUGH CARPENTRY**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

- A. This Section covers the rough carpentry work which includes wood framing, plates, joists, rafters, purlins, wood trusses, blocking, furring, backing, nailers, plywood sheathing, siding, and similar elements, material and accessories, complete and in place according to the contract documents.

##### **1.2 REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN PLYWOOD ASSOCIATION (APA)
1. APA AFG-01      Adhesives for Field-Gluing Plywood to Wood Framing
  2. APA Form E30    Design/Construction Guide, Residential and Commercial
- C. AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
1. AWPA M4            Standard for the Care of Preservative-Treated Wood Products
- D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A 307        Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength
  2. ASTM A 653        Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  3. ASTM D 3498       Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
  4. ASTM F 1667       Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- E. AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
1. AWPA U1-13        Use Category System: User Specification for Treated Wood
- F. NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)
1. NFOPA-01           National Design Specification for Wood Construction
  2. NFOPA-02           Manual for Wood Frame Construction
- G. TRUSS PLATE INSTITUTE (TPI)
1. TPI TPI-85           Design Specification for Metal Plate Connected Wood Trusses
  2. TPI QST 88           Quality Standard for Metal Plate Connected Wood Trusses Addendum to TPI-85

## H. WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

1. WWPA-01 Western Lumber Grading Rules

### 1.3 RELATED WORK

- A. Related work in other sections includes but is not limited to:

1. Section 01 33 00 Submittal Procedures

### 1.4 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. Manufacturer's catalogs showing rough hardware conforming to or equivalent to hardware indicated on the Contract Drawings.
- C. Structural and Miscellaneous Wood Members: Design analysis and calculations of fabricated wood trusses shall show design criteria used to accomplish the applicable analysis. Calculations and drawings shall be stamped by a Professional Engineer licensed in the State of Utah.
- D. Shop Drawings: Drawings of fabricated wood trusses shall indicate materials and shop and field erection details including methods of fastening.
- E. Manufacturer's Certificates: Manufacturer's certificates attesting that lumber and material not normally grade marked or exempt from being grade marked meets the specified requirements.

### 1.5 DELIVERY AND STORAGE

- A. Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

### 1.6 QUALITY ASSURANCE

- A. Materials and assembly shall be inspected to determine compliance with the Building Code.
- B. At completion of fabrication of the trusses, the fabricator shall submit a certificate of compliance to Engineer stating that the work was performed in accordance with the contract documents.

### 1.7 MEASUREMENT AND PAYMENT

- A. Rough carpentry shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

## **PART 2 PRODUCTS**

### **2.1 LUMBER AND SHEATHING**

- A. Grading and Marking: Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade species used. Except for plywood and lumber; bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.
- B. Sizes: Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.
- C. Trussed Rafters: Rafters shall be a prefabricated design. Connections shall be made with light-metal plate-connectors. Light-metal-plate-connected wood trusses shall be designed in conformance with TPI TPI-85 and fabricated in conformance with TPI QST-88.
- D. Plywood: Plywood shall be APA performance rated, Grade C-D with exterior glue. Sheathing for roof without corner bracing of framing shall have a span rating of 16/0 or greater for supports 16 inches on center and a span rating of 24/0 or greater for supports 24 inches on center.
- E. Wood: Provide dressed lumber, S4S, unless otherwise indicated. Provide seasoned lumber with 19 percent maximum moisture. For structural framing use lumber indicated in structural notes and Drawings or approved equivalent,

### **2.2 TRUSSES**

- A. Marking: Each truss shall be marked or have permanently affixed thereto the following information near the center of the span on the bottom chord: truss manufacturer's name and address, design load, and spacing of the trusses.
- B. Connector plates shall be designed by the truss manufacturer in accordance with TPI Standards. Structural plates shall be structural quality steel and hot-dip galvanized according to ASTM A 653. Connector plates shall be provided on both sides of the truss, i.e. 2 plates per joint.

## 2.3 PRESERVATIVE TREATMENT

- A. The treatment of lumber, timber, and plywood shall meet the requirements of AWPB UC3B for above ground use only. All products shall bear the appropriate AWPB Quality Mark. The wood shall then be dried to the moisture content specified and marked with the word "Dry." Surfaces of lumber that will be exposed shall not be incised. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPB M4. Wood preservative shall be **Wolman AG by Arch Treatment Technologies, Preserve CA by Viance**, or approved equal. Unless otherwise specified the following items will always be treated:
1. All wood members used in built-up roofing systems.
  2. All wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.
  3. All wood members used for rough framing of openings in exterior concrete or masonry walls.
  4. Nailing strips or nailers used in conjunction with roof systems.

## 2.4 ACCESSORIES AND NAILS

- A. Anchor Bolts shall conform to ASTM F1554 Grade 36, size as indicated, complete with nuts and washers.
- B. Expansion Shields shall be the Type and size best suited for intended use.
- C. Joist Hangers and Truss Clips shall be steel galvanized, size to fit members where used, sufficient strength to develop the full strength of supported member, complete with any special nails or bolts required. Framing devices shall be manufactured by **Simpson Strong-Tie Company, Inc.**, or approved equal.
- D. Nails and Staples shall be of the size and type indicated for purpose and shall conform to the requirements of ASTM F 1667. Nails used with treated lumber and sheathing shall be galvanized.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS

- A. General: Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Nailing shall be in accordance with the recommended Nailing Schedule as contained in NFOPA-02. Where detailed nailing requirements are not specified, nail size and nail spacing shall be sufficient to develop an adequate strength for the connection without splitting the members. Installation of timber connections shall conform to applicable requirements of NFOPA-01. Members shall be framed for passage of ducts and pipes shall be cut, notched, or bored in accordance with applicable requirements of NFOPA-02. Rafters, purlins, and joists shall be set with crown edge up. Leveling of joists, beams, and girders on masonry or concrete shall be with slate or steel; on wood or metal leveling shall be without shims.
- B. Cutting and Notching: Wood members shall not be cut, notched or bored more than 1/4 of their depth without adequate and approved reinforcing.

- C. Sill Plates: Sill plates shall be set level and square and anchor bolted at not more than 2 feet 8 inches on centers and not more than 12 inches from end of each piece. A minimum of two anchors shall be used for each piece. Sill plates and other wood resting on or embedded in concrete or masonry shall be pressure treated.
- D. Wall Framing: Wall studs shall be installed at a spacing of 16-inches on center unless otherwise indicated on the Drawings. A single plate shall be provided at the bottom and a double plate at the top of wall framing unless noted otherwise. Joints in the top plates shall be staggered not less than 4 feet.
- E. Roof Framing or Rafters: Tops of supports or rafters shall form a true plane. Valley, ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters. Valleys, hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip and valley rafters, shall be spiked to wall plate and to ceiling joists with no less than three 8-penny nails. Rafters shall be toe-nailed to ridge; valley, or hip members with at least three 8-penny nails. Rafters shall be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters shall be secured to wall plates by clip angles. Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed. Valley rafters longer than the available lumber shall be double, with pieces lapped not less than 4 feet and well spiked together. Trussed rafters shall be installed in accordance with TPI TPI-85.
- F. Blocking and Backing: Blocking and backing shall be nominal 2-inch thick material and shall be provided as necessary to meet the latest codes for lateral bracing and for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide fire stopping. Blocking and backing shall be cut to fit between framing members and rigidly nailed thereto.

### **3.2 INSTALLATION OF SHEATHING**

- A. Plywood: Sheathing shall be applied in accordance with APA standards and with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 6 inches on center and at intermediate supports 12 inches on center, unless noted otherwise in Contract Drawings. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

### **3.3 INSTALLATION OF ROOF TRUSSES**

- A. Contractor shall be responsible for field erection of the trusses, including proper handling, safety precautions, temporary bracing to prevent toppling, and other safeguards which are consistent with good workmanship and building erection practices.
- B. Contractor shall comply with all applicable requirements and recommendations of TPI.

- C. Contractor shall not field repair, cut or otherwise alter trusses without consulting the truss manufacturer.

- END OF SECTION -



**SECTION 06 20 23**  
**INTERIOR FINISH CARPENTRY**

**PART 1      GENERAL**

**1.1      DESCRIPTION**

- A. Work of this Section, as shown or specified, shall be provided by the Interior Contractor and shall be in accordance with the requirements of the Contract Documents.
- B. This Section covers the finish carpentry work which includes coordination, fabrication, and installation of all interior exposed wood members shown on Contract Drawings and specified herein, including but not limited to the following:
  - 1. Lumber
  - 2. Standing and Running Trim
  - 3. Moldings
  - 4. Wood Shelving
  - 5. Plastic Laminate
  - 6. Paneling
  - 7. Plywood
  - 8. Miscellaneous Items

**1.2      REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN HARDWOOD ASSOCIATION (AHA)
  - 1. AHA A 135      Hardboard Plywood
- C. AMERICAN WOODWORK INSTITUTE (AWI)
  - 1. AWI 0620      Finish Carpentry/Installation
- D. AMERICAN PLYWOOD ASSOCIATION (APA)
  - 1. APA AFG-01      Adhesives for Field-Gluing Plywood to Wood Framing
- E. AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
  - 1. AWPA M4      Standard for the Care of Preservative-Treated Wood Products
  - 2. AWPA U1-13      Use Category System: User Specification for Treated Wood
- F. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM E 84      Standard Test Method for Surface Burning Characteristics of Building Materials

G. HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

1. HPVA HP-1            American National Standard for Hardwood and Decorative Plywood

H. NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)

1. NFOPA-01            National Design Specification for Wood Construction
2. NFOPA-02            Manual for Wood Frame Construction

I. NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

1. NHLA Rules           Rules for the Measurement and Inspection of Hardwood and Cypress

J. WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

1. WWPA-01            Western Lumber Grading Rules

**1.3 RELATED WORK**

A. Related Work in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes

**1.4 SUBMITTALS**

A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.

B. Submit the following items of finish carpentry:

1. Shop Drawings, indicating fabrication and installation methods, to include plans and elevations and details. Indicate required anchorage and blocking, accessory items, field dimensions, materials and finishes. Indicate compliance with specification requirements. Indicate weight of any materials or systems to be suspended or which require support from structure.
2. Manufacturer's Product Data for all specialty items not manufactured by the Finish Carpentry Fabricator.
3. Two samples of each species and finish of wood specified. Samples shall be minimum 12-inch by 12-inch finished as specified on one face, one edge, and one end. Samples shall be fire retardant treated wood where such has been specified or required by codes. Review will be for color and texture only; compliance with other requirements is the responsibility of Interior Contractor. Samples of finishes shall be applied on the appropriate wood or base material as will occur in the final Finish Carpentry item when installed.
4. Product data for each type of process, factory and non-factory fabricated product. Indicate component materials, dimensions, profiles, textures, colors and include construction and application details.
5. Where variations in wood and finish may occur, a minimum of three variations showing the extremes which may be expected of any and all wood and finishes as specified shall be submitted to ENGINEER for approval. Minimum size: 12-inch by 20-inch.

6. Where required by OWNER or ENGINEER, the Interior Contractor shall provide full size mockup of panel or woodwork assembly.
7. Interior Contractor shall submit to ENGINEER three samples 20-inch minimum length of all moldings or molding assemblies to be used for the Project. These shall be full size and finished as specified in the Contract Documents.

## **1.5 DELIVERY AND STORAGE**

- A. Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.
- B. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.
- C. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.
- D. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

## **1.6 QUALITY ASSURANCE**

- A. Comply with applicable provisions for Premium Grade as defined in the latest edition of the AWI Quality Standards for all materials, fabrication and workmanship for all work of this Section.
- B. All Work of this Section shall be performed by skilled mechanics of the trade and shall be of the highest quality. Comply with applicable Industry Standards for all Work and materials as specified.
- C. The Interior Contractor shall be responsible for obtaining and complying with all code and regulatory agency requirements for materials and methods.
- D. The Interior Contractor shall be responsible for accurately obtaining all field dimensions related to his/her work prior to fabrication. Where discrepancies are found, he/she shall notify ENGINEER immediately in writing.
- E. Protect sanded and finished surfaces from soiling and damage during handling and installation.
- F. Provide temporary protection of all Finish Carpentry as required to protect Work from damage.

## **1.7 MEASUREMENT AND PAYMENT**

- A. Finish carpentry shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

## **PART 2        PRODUCTS**

### **2.1        MATERIALS**

- A. All woodwork materials shall be new and shall conform to the Premium Grade requirements of the AWI Quality Standards, latest edition.
- B. All lumber shall be kiln-dried to the average moisture content as recommended by the AWI Quality Standards latest edition appropriate for the climatic conditions of the Site.
- C. All solid wood elements shall be clear, straight-grain lumber of the best grade of specified species as listed by the NHLA. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Solid wood elements shall also be according to the following, unless indicated otherwise on Contract Drawings and/or Specifications:
  - 1. Specie of Face Woods receiving transparent finishes shall be as specified on the Contract Drawings and shall be selected for specified grain with uniform color and grain suitable for use with the finished plywood with which it is used.
  - 2. Face Woods receiving opaque finishes shall be Birch, Poplar or custom grade but otherwise shall have same specification as solid stock for Face Woods above.
  - 3. Unexposed woods shall be Custom grade Poplar, kiln dried.
- D. All veneer core elements shall be clear straight-grain lumber of the best grade of the specified species as listed by the NHLA Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Where veneer differs on two sides, veneers shall be of similar thickness, density, and characteristics to prevent any warpage. Veneer core elements shall also be according to the following, unless indicated on Contract Drawings or Specifications:
  - 1. Adhesives shall be water-resistant resin or approved equal; process shall be hot plate method using the following number of plies to achieve specified thickness:
    - a. 1/4-inch overall thickness shall be of 3- ply veneer core construction.
    - b. 3/8-inch overall thickness shall be of 5- ply veneer core construction.
    - c. 1/2-inch overall thickness shall be of 5- ply veneer core construction.
    - d. 3/4-inch overall thickness shall be of 7- ply veneer core construction.
    - e. 1-inch overall thickness shall be of 9-ply veneer core construction.
  - 2. Where burl paneling is specified, core must be cross banded with poplar prior to applying burl veneer.
  - 3. Provide Douglas Fir or Poplar V-type solid edge trim on all exposed edges of plywood not designated to be surfaced by plastic laminate.
  - 4. For Face Woods receiving transparent finishes, Species shall be as specified on drawings; faces shall be selected and matched by the Interior Contractor with respect to cutting lengths, uniformity of color, figure, and grain character. Face veneers shall not contain open joints, face depressions, glue stain or other manufacturing irregularities.
  - 5. Face Woods receiving opaque finishes shall have custom grade (face veneer) Birch or Poplar select, but otherwise shall have same specification as Plywood for Face Woods (Paragraph 2.1.D.1).
  - 6. Unexposed woods shall be Birch, Poplar or Douglas Fir, rotary cut, Unselect, good one side, interior type plywood, one side Grade A and one side Grade B; Grade A faces shall not contain plugs, knots, pitch pockets, splits, rough grain or other open defects.

7. Wood for plastic lamination shall be minimum 3/4-inch Mahogany face core plywood, good one side.
- E. All particle board shall be resin impregnated wood flakes of high-density construction as manufactured by **Boise Cascade Corporation, Roseburg**, or approved equal and shall be 3/4-inch minimum thickness, unless otherwise specified.
  1. For Enameled Face Woods: High density particle board may be substituted for plywood panels, unless specified otherwise on Contract Drawings.
  2. For Unexposed Woods: High density particle board may be substituted for plywood panels, unless specified otherwise on Contract Drawings.
- F. All masonite shall be 1/8-inch thick tempered, as manufactured by **Masonite Corporation**, or an approved equal.
- G. All Finish Carpentry shall be finished as indicated on Contract Drawings and Specifications. Transparent and Opaque Finishes shall match approved samples submitted according to Section 01 33 00 and Paragraph 1.4 above. All plastic laminate finishes shall be of the quality, color and finish as indicated on the Contract Drawings and Specifications.

## **2.2 SOFTWOOD PLYWOOD**

- A. Each sheet of plywood must bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
- B. The mark must identify the plywood by species group or identification index, and show glue type, grade, and compliance with PS1.
- C. Plastic Laminate Plywood Cores to be exterior type in any species and in Grade A or as required per the Contract Documents.
- D. Shelving Plywood to be interior type in any species and in grade or as required per Architect.

## **2.3 HARDWOOD PLYWOOD**

- A. Comply with AHA A 135.
- B. Each sheet of hardwood plywood must bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark must identify the plywood by species group or identification index, and show glue type, grade, and compliance with HP-1.
- C. Hardwood plywood type to meet minimum standards and must comply with specifications.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. All required hardware and accessories shall be furnished and installed by Interior

Contractor and shall be as indicated on Contract Drawings and Specifications. Where specific products are not specified in the Contract Documents, the Interior Contractor shall recommend hardware to provide the function or condition indicated in the Contract Documents. Hinges, screws, clips and other mounting, attachments or fasteners to be concealed unless otherwise noted on Contract Drawings.

- C. Interior Contractor shall submit samples of each hardware item/type and accessory item/type to ENGINEER for approval according to Paragraph 1.4 above and Section 01 33 00.
- D. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives. VOC levels shall not exceed what is approved for Project.
- E. All Finish Carpentry hardware and accessories shall be installed in accordance with manufacturer's recommendations.

## **2.5 OTHER MATERIALS**

- A. Interior Contractor shall be responsible for providing and installing all items and materials as indicated on Contract Drawings and Specifications comprising all or part of the Finish Carpentry shown. Such items and materials shall be fabricated and/or installed according to manufacturer's recommendations and comply with applicable AWI Quality Standards and Industry Standards.
- B. All paint and other finish material shall be pure, unadulterated and best quality from specified manufacturer as indicated on the Contract Drawings and Specifications. (See Section 09 90 00 – Painting and Finishes).
- C. All finish materials shall be flame retardant or treated with flame-retardant process where required by local code. Should flame-retardant process cause change in color and effect on finish material, Interior Contractor shall notify ENGINEER.
- D. All finishes and processes shall be in compliance with code requirements for the location of installation.
- E. All transparent finishes shall be alcohol, water and burn resistant.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION OF CONDITIONS**

- A. The Interior Contractor shall be responsible for examination of the substrate and the conditions under which the Work under this section is to be performed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work under this section until unsatisfactory conditions have been corrected.

- B. Verify surfaces and substrates are prepared to receive products of this section.
- C. If substrate preparation is the responsibility of another installer, notify ENGINEER of unsatisfactory preparation before proceeding. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- D. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the Project conditions.
- B. Clean surfaces thoroughly prior to installation.
- C. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

### **3.3 FABRICATION**

- A. All Work shall be performed in such manner as to fulfill the intent of the Contract Drawings and Specifications.
- B. All items to be mill fabricated per AWI Premium Grade specifications and according to the sizes and designs indicated on the Contract Drawings and Specifications, and assembled in single and complete units insofar as the dimensions thereof will permit shipment to and installation at the building. Large pieces requiring sectional construction shall have their several parts accurately fitted and aligned with each other and be provided with ample screws, glue and bolt blocks, tongues, grooves and splines, dowels, mortises and tenons, screws, bolts, or suitable means of concealed fastening, as required to render the Work substantial, rigid and permanently secured in proper position to each related section.
- C. Where necessary to fit at site provide ample allowance for cutting and fitting. Sufficient additional material shall be allowed to permit accurate scribing to walls, floors and related work; and due allowance made wherever possible for such shrinkage as may develop after installation. All single and sectional units shall be provided with adequate cleating, blocking, crating and other forms of protection as required to preclude damages thereto during shipping and handling and installation.
- D. Framing and blocking members shall be assembled with bolted and screwed connections, and shall be secured to the structural backings with expansion screws, or toggle bolts, as required, spaced and installed so as to insure ample strength and rigidity. Rails and stiles shall be mortised and tenoned, work neatly mitered and membered, all butt joints made flush and smooth, and all permanent joints made up with water-resistant glue. All fixtures shall be assembled without face screws or nails, except where it may be necessary to attach trim items. All face screws or nails which are necessary to attach trim items shall be countersunk and plastic wood or wood plugs used to cover heads, and the

plug neatly touched up to match finish. The heads of all screws used in any assembly shall be countersunk below the surface.

- E. All items where paint is required shall be shop spray finished, except where impractical or otherwise specified.
- F. Backsides of all Finish Carpentry concealed by the building shall be given a prime coat of paint, color to closely approximate the value and hue of the face finish.
- G. All shelving shall be adjustable unless indicated otherwise on Contract Drawings and Specifications. Shelving standards shall be concealed unless otherwise noted.
- H. Plastic Laminate edges shall be square, self-edged, or postformed as indicated on drawings. Metal trim is not acceptable. Edges shall be neatly beveled, joints shall be minimized in quantity and be made to a smooth hairline and puttied. Appearance of unsightly or excessive joints will be cause for rejection.

### **3.4 INSTALLATION**

- A. Installation at the Project shall be by skilled mechanics supervised by the Interior Contractor in accordance with accepted standards.
- B. Install in accordance with the manufacturer's recommendations and the approved shop drawings and in proper relationship with adjacent construction.
- C. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
- D. Install all Finish Carpentry straight, plumb, level and in true alignment except where otherwise indicated. Fit all joints closely and fasten all pieces rigidly in place. Nails shall be finish or casing nails. Countersink nail heads and leave ready for putty. Joints shall be neatly matched and mitered. Fill exposed joints prior to jointing.
  - 1. Finished size shall be as indicated on the Contract Drawings.
  - 2. Surfaces shall be left free from hammer marks, free from warp, twist, open joints or other defects and shall be cleaned, scraped and sanded ready for finishing.
  - 3. Lengths of all running trim shall be as long as practical.
  - 4. Shim as required using concealed shims.
- E. Cut Finish Carpentry to fit unless specified to be shop fabricated or shop-cut to exact size. Where Finish Carpentry abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.
- F. Distribute defects allowed in the quality grade specified to the best overall advantage, when installing job assembled items.
- G. Attach Finish Carpentry securely in place with uniform joints providing for thermal and building movements. Attach to substrates by anchoring and fastening as shown, as required by recognized standards, and as follows:
  - 1. Nailing: Blind nail where possible. Use fine finishing nails where exposed. Set exposed nail heads for filling except for exterior wood which is to receive a natural finish (if any).



2. Anchoring: Secure Finish Carpentry to anchors or blocking built-in or directly attached to substrates.
- H. For standing and running trim, install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
    1. Install trim after gypsum board joint finishing operations are completed.
    2. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement for warping. Countersink fastener heads on exposed carpentry work and fill holes.
    3. Cope moldings at returns, miter interior angles and corners.
  - I. Where finishes are applied at job site, clean items and fill nail holes in preparation for finishes application. Where work is to receive a transparent finish, use matching wood filler.
  - J. For Fire-Retardant Finish Carpentry, handle, store and install in accordance with manufacturer's direction and as required to meet the required classification or rating. Provide special fasteners, adhesives and other accessories as tested and listed for the type of fire-retardant work indicated. Re-coat any and all cut surfaces with a heavy brush coating of the same compound used for wood treatment.
  - K. Fit Finish Carpentry to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper support.
  - L. Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.
    1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as recommended by panel manufacturer.
    2. Conceal fasteners to greatest practical extent.
  - M. Adjust all hardware for smooth operation.
  - N. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.

### **3.5 CLEANING AND PROTECTION**

- A. Clean shop finished work, touch-up finish as required and remove and refinish damaged or soiled areas of finish.
- B. Protect installed Finish Carpentry from damage by Work of other trades until OWNER's acceptance of the Work. Subcontractor to advise Interior Contractor of procedures and precautions for protection of materials and installed work from damage and of the required

temperature/humidity conditions which must be maintained during the remainder of the construction period in areas of Finish Carpentry installations.

- C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.
- D. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

- END OF SECTION –

**SECTION 07 11 00**  
**MOISTURE PROTECTION**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section provides specifications for all waterproofing and damp proofing of the buried or below grade concrete surfaces, including moistureproof underlays for concrete slabs.

**1.2 RELATED WORK**

- A. Related Work in other sections includes, but is not limited to:
1. Section 01 33 00 Submittal Procedures

**1.3 QUALITY ASSURANCE**

- A. Performance and Design Requirements. Prior to application of waterproofing, CONTRACTOR shall cause a representative of the manufacturer of the materials to inspect and certify that the surfaces to be waterproofed are in a condition suitable for application of the waterproofing. Following application of the waterproofing, CONTRACTOR shall cause a representative of the manufacturer of the materials to inspect and certify that the materials were applied in complete accordance with the manufacturer's current recommendations.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 450 Standard Specification for Coal-Tar Pitch Use in Roofing, Dampproofing, and Waterproofing
2. ASTM D 882 Test Method for Tensile Properties of Thin Plastic Sheeting
3. ASTM D 1668 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing.
4. ASTM E 1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slab
5. ASTM F 1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

C. PRESSURE SENSITIVE TAPE COUNCIL (PSTC)

1. PSTC 101 International Standard for Peel Adhesion of Pressure-Sensitive Tape

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. Submit manufacturer product data, cut sheets, and recommended installation instructions.

- C. Prior to acceptance of the work, CONTRACTOR shall deliver to ENGINEER two copies of the specified certifications for material application.

## **PART 2 PRODUCTS**

### **2.1 WATERPROOF COATING**

- A. Waterproof coating shall be coal tar epoxy resin. Acceptable products are **Bitumastic 300M by Carboline, Targuard Low VOC Coal Tar Epoxy by Sherwin Williamns, PorterTuf 2000 HB Coal Tar Epoxy by Porter Coating, Series 46H-413 HB Tneme-Tar by Tnemec, Amercoat 78HB by PPG Protective & Marine Coatings**, or approved equal.

### **2.2 MOISTUREPROOF COATING**

- A. Moistureproof coating shall be coal tar solution. Acceptable products are **Bitumastic 50 by Carboline, Corothane I Coal Tar by Sherwin Williams, Series 46-465 HB Tnemecol by Tnemec, HE107 by Henry**, or approved equal.

### **2.3 WATERPROOF MEMBRANE**

- A. Water-roof Pitch: Waterproof pitch shall be coal tar pitch.
- B. Membrane Fabric: Membrane fabric shall be coal tar pitch coated open mesh fabric per paragraph 1.2 B.
- C. Reglets: Reglets for anchoring membrane shall be fabricated of 16-ounce copper.
- D. Protective Board: Protective board shall be 2-inch Celotex insulation board treated to prevent decay.

### **2.4 MOISTUREPROOF UNDERLAY**

- A. Plastic Membrane. Plastic membrane for moistureproof underlay shall be an ASTM E 1745 Class A membrane manufactured from virgin polyolefin resins having a minimum film thickness of 10 mils. Plastic membrane shall meet the following specifications:
  - 1. Water Vapor Permeance: 0.05 perms maximum (perm unit = grains/(ft<sup>2</sup>\*hr\*in-Hg)) in accordance with ASTM F 1249.
  - 2. Tensile Strength: 50 lbf/in (minimum) per ASTM D 882.
- B. Acceptable membranes are **Stego Wrap Class A by Stego Industries, Perminator by W. R. Meadows, Vapor Barrier Blue VB10 by Americover**, or approved equal.
- C. Pressure Sensitive Tape. Pressure sensitive tape shall be minimum 3-inch wide, 6 mil pressure sensitive polyethylene tape with acrylic, pressure-sensitive adhesive. Manufacturers shall be **Stego Tape by Stego Industries, Perminator Tape by W.R. Meadows, VTW Vapor Tape by Americover**, or approved equal.

## **PART 3 EXECUTION**

### **3.1 WATERPROOF COATING**

- A. Location. Waterproof coating shall be applied to the water side of walls and bottoms of channels or tanks which are common with areas to be occupied by equipment, piping or personnel. Waterproof coating shall not be applied to those surfaces to receive liquid waterproofing.
- B. Surface Preparation. New concrete to be waterproofed shall have aged at least 60 days and shall have a moisture content of less than 14%. Concrete surface shall be brush treated with a 10% muriatic acid solution and thoroughly flushed with water after 10 minutes.
- C. Walls of existing channels and tanks shall be steam cleaned prior to application of waterproofing material.
- D. Application. Prime coat shall be thinned and applied at the rate of approximately 200-300 square feet per gallon depending on surface condition. Finish coats shall be applied at the rate of 100 square feet per gallon. Final coat shall be black. Total dry film thickness shall be minimum 20 mils. Drying time between coats shall be as recommended by the paint manufacturer.
- E. Application Procedures. Following the manufacturer's application instructions and these application procedures for waterproofing products as listed in paragraph 2.1 are as follows:
  - 1. Prime coat shall consist of one coat of coal tar epoxy resin coating, black. Finish coats shall consist of two coats of coal tar epoxy resin coating, alternating red and black colors.

### **3.2 MOISTUREPROOF COATING**

- A. Location. Moistureproof coating shall be applied to below grade, earth side of outside concrete walls which are common with areas to be occupied by equipment, piping, or personnel. Moistureproof coating is not required for walls to be provided with waterproof membrane or for walls which are poured directly against an excavated surface.
- B. Surface Preparation. Preparation of concrete and masonry walls shall conform to manufacturer's recommendations.
- C. Application. Prime and finish coats shall be applied at the rate of 70 square feet per gallon. The number of finish coats shall be sufficient to produce a dry film thickness of at least 13 mils. Drying time between coats shall be as recommended by the paint manufacturer.

### **3.3 WATERPROOF MEMBRANE**

- A. Location. Waterproof membrane shall be applied to exterior surfaces as designated on the drawings.
- B. Surface Preparation. Concrete surfaces to receive waterproof membrane shall be clean, dry and shall have at least a Class II form finish.

### **3.4 MOISTUREPROOF UNDERLAY**

- A. Install moistureproof underlay in accordance with the manufacturer's written installation instructions.
- B. Location. Unless otherwise noted, moistureproof underlay shall be provided under all concrete floors or floating slabs-on-grade deposited on gravel base or sand. Moistureproof underlay shall be provided under all concrete floors or floating slabs-on-grade with pressure relief valves and gravel base.
- C. Surface Preparation. Backfilled surfaces to receive moistureproof underlay shall be leveled off and smoothed over to minimize contact with sharp edges. Joints shall be sealed by means of pressure sensitive tape. Where pipes and conduits pass through the plastic membrane, they shall be wrapped tightly with separate sheets of membrane which shall then be sealed with tape to the main membrane. Reinforcing steel or mesh shall be supported by small precast placing chairs designed with flat bases to protect the membrane. CONTRACTOR shall exercise care to maintain the integrity of the membrane at all times.

- END OF SECTION -

**SECTION 07 21 00**  
**INSULATION**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section covers the work required to provide and install insulation in buildings and structures, complete and in place.

**1.2 RELATED WORK**

- A. Related Work in other Sections includes, but is not limited to:
1. Section 01 33 00 Submittal Procedures
  2. Section 04 22 00 Reinforced Unit Masonry

**1.3 REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  2. ASTM C 547 Standard Specification for Mineral Fiber Pipe Insulation
  3. ASTM C 549 Standard Specification for Perlite Loose Fill Insulation
  4. ASTM C 553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  5. ASTM C 578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
  6. ASTM C 592 Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
  7. ASTM C 612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
  8. ASTM C 665 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
  9. ASTM C 1029 Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
  10. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics
  11. ASTM D 1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics
  12. ASTM D 2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics
  13. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
  14. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials

C. UNDERWRITERS LABORATORIES (UL)

1. UL1256 Fire Test of Rook Deck Constructions

D. FACTORY MUTUAL (FM)

1. Approval Standard for Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. Submit manufacturer's literature, installation instructions, product test reports and technical data.
- C. Submit manufacturer's certification that the proposed materials comply with this Section.
- D. For foam-in-place insulation, submit a copy of the foam insulation contractor's certification and ICC-ES report and manufacturer's documentation confirming material conforms to ASTM C 1029.

**1.5 DELIVERY AND STORAGE**

- A. Materials shall not be allowed to become wet, soiled, or covered with ice and snow. Manufacturer's recommendations for handling storage and protection shall be strictly followed. If required, during cold weather, store in heated storage areas following the manufacturer's guidelines for minimum and maximum temperatures. Material shall not be exposed to sunlight and shall be protected against ignition. Materials shall be concealed as quickly as possible after completion of work.

**1.6 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for Insulation. Full compensation for all insulation shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which it relates.

**PART 2 PRODUCTS**

**2.1 INSULATION**

- A. Thermal resistance of insulation shall be not less than the R-values shown on the Contract Drawings. R-values shall be determined at 75 degrees F in accordance with ASTM C 518. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages.



- B. The materials and application of building insulation shall conform to the applicable requirement of the Underwriters Laboratories "Fire Resistance Index", Factory Mutual requirements, and the manufacturer's recommendations.
- C. Minimum R-Value in all roof insulation shall be R-30.

## 2.2 FOAMED-IN-PLACE THERMAL INSULATION

- A. Foamed-in-place or sprayed polyurethane foam plastic insulation conforming to the requirements of ASTM C 1029 shall be placed in cavities of masonry walls. Foamed-in-place thermal insulation in walls shall be 2-component cellular plastic insulation comprised of a spray-dried polymeric resin and a foaming catalyst concentrate insulation by frothing/pouring in place. It shall have the following characteristics:

Property	Requirement	Standard
Core Density	0.5-1.0 pcf	ASTM D 1622
Thermal Resistance at 140°F/90 day Aged R Value, at 75°F mean Temp, min	R4.6/inch	ASTM C 518

- B. Foamed-in-place insulation shall be **InsulSmart Interior Foam Insulation by CfiFOAM, Inc., Core-Fill 500 by Tailored Chemical Products**, or approved equal.

## 2.3 CMU BLOCK INSULATION INSERTS

- A. As an alternative to Foamed-in-Place Thermal Insulation, CMU Block Insulation Inserts may be installed. Inserts shall be flame retardant, expandable polystyrene design specifically to fit inside standard two (2) core masonry units. Inserts shall meet the requirements of ASTM C 578 with minimum density of 1.25 pcf. Inserts shall meet the following characteristics:

Property	Requirement	Standard
Thermal Resistance (R) per inch at 75°F (minimum)	4.1	ASTM C 518
Water Vapor Permeance per inch of thickness (minimum)	1.1	ASTM C 355 or ASTM E 96
Water Absorption Percent (%) by Volume (maximum)	1.8	ASTM C 272

- B. CMU Block Insulation Inserts shall be **ThermaSound CMU Block Insert, Korfil by Concrete Block Insulating Systems (DRIS)**, or approved equal.

## 2.4 BLANKET INSULATION

- A. Blanket insulation shall be glass or other inorganic fibers and resinous binders formed into flexible blankets complying with ASTM C 665, Type III, with foiled back vapor barrier laminated to one face, with 1-inch flanges on long edges, and vapor transmission not more than 0.50 perms. Manufacturers shall be **Owens-Corning, CertainTeed, Johns-Manville**, or approved equal.

## 2.5 EXTRUDED POLYSTYRENE BOARD (RIGID) INSULATION

- A. Rigid insulation shall be polystyrene conforming to ASTM C 578, Type IV with surface burning characteristics per ASTM E84 maximum of 5 for flame-spread and 175 for smoke developed. Minimum thermal resistance per inch of R-5.0 per ASTM C 518 at 75°F mean temperature. Minimum compressive strength of 25 psi per ASTM D 1621.
- B. Insulation for roof decks shall be listed per UL 1256 and shall be in compliance with FM Class I roof decks.
- C. Insulation thickness in interior walls shall be 4 inches.
- D. Manufacturers shall be **Dow Chemical, Owens Corning**, or approved equal.
- E. Sill Sealer: Mineral wool, 1 inch thick and compressible to 1/32 inch, width of sill, designed to perform as an air, dirt, and insect seal.

## 2.6 ALUMINUM SHEETING WITH RIGID INSULATION

- A. Vaults with electric power shall be insulated with a combination of rigid insulation (see 2.4) and 24-mil thick (min) aluminum sheeting coated flat white
- B. Accessories:
  - 1. Adhesive: As recommended by manufacturer. Adhesive shall be formulated specifically to bond insulation to steel (hatches and panels) and to concrete surfaces.
  - 2. Tape: Aluminum foil tape with facing to match rigid insulation as recommended by the manufacturer.
  - 3. J-Channel: PVC Closure strip as recommended by manufacturer for terminations.
  - 4. Clip Strip: PVC closure strip for vertical and horizontal seams.
  - 5. Fasteners: Hilti Insulation Fasteners (IZ-type), or approved equal
- C. Aluminum Sheet Manufacturer: **Insul-Mate by RPR Products, Inc.**, or approved equal.

## **2.7 EXTRUDED POLYSTYRENE BOARD (RIGID) INSULATION (BURIED LOCATIONS).**

- A. Rigid insulation for buried locations shall be polystyrene conforming to ASTM C 578, Type IV with surface burning characteristics per ASTM E84 maximum of 75 for flame-spread and maximum of 450 for smoke-developed. Minimum thermal resistance per inch of R-5.0 per ASTM C 518 at 75°F mean temperature. Minimum compressive strength of 25 psi per ASTM D 1621.
- B. Insulation thickness for exterior foundation walls shall be 1.5 inches minimum.
- C. Manufacturers shall be **Dow Chemical, Owens Corning**, or approved equal.
- D. Sill Sealer: Mineral wool, 1 inch thick and compressible to 1/32 inch, width of sill, designed to perform as an air, dirt, and insect seal.

## **2.1 SOUND ATTENUATION FIRE BATTS (SAFB)**

- A. SAFB are REQUIRED inside all 2x4 electrical room walls. Sound attenuation batts shall be mineral wool made from inorganic fibers. SAFBs shall meet the requirements of ASTM C 665, Type I, unfaced and shall have a maximum flame spread index of zero (0) and a maximum smoke developed index of zero (0) per ASTM E 84.
- B. Minimum Density shall be 2.4 pcf.
- C. R-value shall be as shown on the Contract Drawings.
- D. Manufacturer, or approved equal:
  - 1. Rockwool – Safe'n'Sound
  - 2. Owens Corning – Thermafiber SAFB
  - 3. Johns Manville – MinWool SAFB

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Verify substrate and adjacent materials and insulation board are dry and ready to receive adhesive.
- B. Verify mechanical and electrical services within walls have been installed and tested.

### **3.2 INSTALLATION OF INSULATION**

- A. Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the R-values shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

### **3.3 INSTALLATION OF FOAMED-IN-PLACE THERMAL INSULATION**

- A. The polyurethane foam shall be placed in 4-foot lifts. All insulation shall be done in close coordination with the masonry contractor to allow quality control.
- B. The polyurethane foam shall be applied by qualified firms with proper dispensing equipment.
- C. Apply in accordance with ASTM C 1029 guidelines and the manufacturer's instructions.

### **3.4 INSTALLATION - RIGID INSULATION**

#### **A. Foundation Perimeter:**

1. Adhere a 6 inches wide strip of polyethylene sheet over joints with double beads of adhesive each side of the joint. Tape seal joints between sheets. Extend sheet full height of joint.
2. Install boards on foundation wall perimeter, horizontally. Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.
3. Extend boards over expansion joints, unbonded to foundation 12 inches either side of joint.

#### **B. Exterior Walls:**

1. Apply adhesive in 3 continuous beads per board length. Daub adhesive tight to protrusions.
2. Install boards on wall surface perimeter, vertically. Place membrane surface of insulation against adhesive.
3. Place boards in a method to maximize contact bedding. Stagger side joints. Butt edges and ends tight to adjacent board and to protrusions.
4. Place 24" side polyethylene sheet at perimeter of wall openings from adhesive vapor and air retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor and air retarder.

#### **C. Cavity Walls:**

1. Secure impale fasteners to substrate at a frequency of 6 per insulated board.
2. Apply adhesive in 3 continuous beads per board length. Daub adhesive tight to protrusions to ensure continuity of vapor and air retarder.
3. Install boards horizontally between wall reinforcement.

#### **D. Under Concrete Slabs:**

1. Place insulation under slabs on grade after base for slab has been compacted.
2. Prevent insulation from being displaced or damaged while placing vapor retarder and placing concrete slab.

### **3.5 INSTALLATION - BATT INSULATION**

- A. Install batt insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install batt insulation without gaps or voids
- C. Trim insulation neatly to fit spaces. Use batts free of damage.

- D. Fit insulation tight in spaces airtight to exterior side of mechanical and electrical services within the plane of insulation.
- E. Protect all insulation materials during storage and insulation from moisture, tears or other damage. All damaged material shall be replaced at no additional cost to OWNER.

- END OF SECTION –

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**SECTION 07 32 00**  
**METAL ROOFING SYSTEM**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall furnish and install metal roofing and soffit panels, system support framing, and appurtenant work, complete and in place. Metal roofing shall be a concealed fastener metal roofing system.
- B. The principal items of sheet metal work included in the metal roofing system shall include sheet metal flashing, covers, trim, enclosure batts, collars and sleeves at all roof penetrations, metal soffit panels, and all other sheet metal items necessary for a complete and watertight metal roofing system.
- C. The metal roofing applicator shall coordinate his work with sheet metal gutter work and shall report to CONTRACTOR and ENGINEER if any sheet metal work provided by others affects his work negatively.

**1.2 RELATED WORK**

- A. Related work in other sections includes but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures

**1.3 REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - 2. ASTM A 924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  - 3. ASTM D 226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
  - 4. ASTM D 1938 Standard Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method
  - 5. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
  - 6. ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - 7. ASTM E 1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
  - 8. ASTM E 1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

C. UNDERWRITERS LABORATORY (UL)

1. UL 580 Test for Uplift Resistance of Prepared Roof Assemblies

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. Submit detailed shop drawings showing materials, gages, finishes, layout, corners, trim, flashing, enclosures, edge conditions, jointing, profiles, supports, fasteners, fabrication of special shapes, and method of attachment to adjacent construction to ENGINEER prior to fabrication. Submit drawings indicating roof size, location and type of penetrations, perimeter and penetration details, roof insulation make-up and sheet layout that have been accepted by an authorized manufacturer's representative.
- C. Submit manufacturer's literature indicating materials, finish, construction, and method of installation of prefabricated items and sealant.
- D. Provide color samples for color selection by OWNER.
- E. Submit the following test reports, certified by an Independent Testing Laboratory or a professional engineer registered in the State of Utah to verify the proposed roofing will meet performance requirements of this Specification:
  1. Thermal Cycle Test
  2. ASTM E-330 Adapted to Test Formed Metal Panels
  3. Clip Fastener Pull-Out Tests and Calculations
  4. UL 580 Class 90
  5. Concentrated Load Test Data
  6. Air Infiltration (E-283) and Water Penetration (E-331) Test Results
  7. Coating Performance Testing
- F. Submit certification by the manufacturer that the roofing assembly is listed in the UL Building Materials Directory with a Class 1-90 wind uplift rating, including relevant construction number.

**1.5 WARRANTIES**

- A. Manufacturer shall provide to OWNER written warranty that the roof panels will not rupture, fail structurally, or perforate due to corrosion for a period of 20 years from the date of installation.
- B. Roofing manufacturer shall provide written 10-year material and labor warranty beginning at the date of final acceptance.
- C. CONTRACTOR shall provide to OWNER written warranty that the roof system is installed in accordance with the manufacturer's recommendations and will be free from defective workmanship and remain watertight and weatherproof with normal usage for two (2) years following Project Substantial Completion date.

**1.6 QUALITY ASSURANCE**

- A. A single installer shall perform the work of this Section and shall have completed



projects of similar scope and complexity.

## **1.7 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for roof systems. Full compensation for roofing systems shall be considered as included in the contract unit or lump sum bid prices for the various items of the Contract to which roof system relates.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Subject to compliance with the requirements, manufacturers who may offer metal roofing systems and products, which may be incorporated into the work, include **AEP Span**, **Fabral**, or approved equal.

### **2.2 ROOF PANELS**

- A. Minimum Performance Ratings and Properties:
  - 1. Air infiltration: Panel shall have no air infiltration at 20 psf pressure differential and no air exfiltration at 20 psf pressure differential when tested in accordance with ASTM E 1680.
  - 2. Water penetration: Panel shall have no leakage through panel joints when tested in accordance with ASTM E 1646 at static pressure differential of 20.0 psf.
  - 3. Provide UL90 rated roofing system that has been tested in accordance with UL 580 test procedure. Panels shall be capable of spanning 5'-0" on-center purlins with UL90 rating.
- B. Profile:
  - 1. Roof panels shall be factory formed ribbed seam pattern with minimum 1" high seams and a nominal panel width of 16 inches.
  - 2. Soffit panels shall be 12-inches wide, 1-1/2" deep, 22- gauge, G90 galvanized finish steel, with concealed fastener, lock-joint design and shall be continuous-vented.
- C. Length:
  - 1. Provide panels of sufficient length to minimize end laps.
- D. Profile Composition:
  - 1. Base metal shall be a minimum 24-gage structural steel (minimum yield strength 50,000 psi) with G90 hot dipped galvanized coating conforming to ASTM A 653.
  - 2. Sheet metal trim, flashing, and accessories shall be the same material, gauge, finish, and color as the metal roofing.
  - 3. Paint Finish:
    - a. All panels shall receive a factory applied Kynar 500/Hylar 5000 finish applied to both sides of the panel over the base protective coating, or approved equal. The exposed side coating shall have a minimum total dry film thickness of 1.0 mil and the underside coating shall have a minimum total dry film thickness of 0.5 mil. Color to be as determined by OWNER.

E. Concealed-Clips:

1. Material: 18-gauge steel with class G60 galvanized coating.
2. Configuration: clips shall be designed so as to attach with two concealed fasteners, and fully attach two ribs of every panel.
3. Spacing: In accordance with the manufacturer's recommendations.

F. Fasteners:

1. Self-drilling or self-tapping galvanized steel screws and/or stainless steel pop rivets painted to match the panels where visible, per the panel manufacturer's recommendations.

G. Sealants:

1. Sealants shall not contain oil, asbestos, or asphalt. Factory applied sealant shall be applied in the seam and designed for metal to metal concealed joints. Field applied panel end sealant shall be mastic tape sealant. Exposed sealant shall be one-part polyurethane joint sealant. All sealants used shall be as recommended by the metal roofing manufacturer for the job conditions and warranty requirements.

H. Weather resistive barrier:

1. Membrane underlayment shall be composed of a high-strength, spun-bonded polypropylene base sheet, co-extruded on both sides with UV stabilized polyolefin, weight 30-pound. Membrane underlayment shall conform to ASTM D 226, Type II. Permeability shall be 0.54 perms maximum in accordance with ASTM E 96, Procedure A, and tear strength shall be minimum 20 pounds in accordance with ASTM D 1938. Membrane underlayment shall be **Grace Tri-Flex 30 by Grace Construction Products**, or approved equal.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify proper placement of all roof openings, pipes, curbs, sleeves, ducts, vents and drains.

### **3.2 SUBSTRATE PREPARATION**

- A. Comply with manufacturer's instructions for preparation of substrate to receive roofing. Clean substrate of dust, debris and other substances detrimental to the roofing work.

### **3.3 NAILERS**

- A. Install treated wood nailers at roof perimeters, at base of roof projections, and around specified roof penetrations.
1. Total nailer height shall match total thickness of insulation being used. Install with 1/8" gap between each length and at changes in direction.
  2. Firmly fasten nailer to the deck, wall, or existing structurally sound and secured nailer at (16") o.c. maximum, so as to resist a force of 200 pounds per lineal foot in any direction.

3. Taper nailer where applicable to be flush at point of contact with membrane in either the vertical or horizontal applications.

### **3.4 GENERAL**

- A. The metal roofing shall be installed by an applicator and fabricator approved by the roofing system manufacturer who has working experience with the roofing system. Contractor shall provide a letter signed by the roofing manufacturer that the installer is an approved applicator and fabricator of the roofing system.
- B. The metal roofing systems shall be installed in accordance with the manufacturer's instructions and recommendations applicable to the job conditions and supporting substrates.
- C. The panels and other components of the system shall be securely anchored and placed with concealed fasteners and shall be provided with provisions for thermal/structural movement.
- D. Shim and align panel units within installed tolerances of 1/4-inch in 20 feet on level/plumb/slope and location/line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- E. Joint sealers shall be furnished and installed where necessary or where required for weatherproofing of the system.

### **3.5 INSTALLATION**

- A. Metal panels shall be installed in accordance with the approved shop drawings and the manufacturer's recommendations.
- B. Remove any strippable protective coating on the panels and flashings prior to installation and in any case do not allow the strippable coating to remain on the panels in extreme heat, cold, or in direct sunlight or other UV source.
- C. Loosely lay roof insulation with end joints staggered. (Stagger joints between layers.) Joints shall be 1/4" or less in width. Neatly cut and fit insulation around roof penetrations and projections. Install only dry insulation and only as much insulation as can be covered the same day with membrane and completed.

### **3.6 CLEANING AND PROTECTION**

- A. Panels and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-ups or similar minor repair procedures, shall be removed and replaced at no cost to Owner.
- B. Temporary protective coverings and strippable films shall be removed from the materials during installation. Upon completion of the work, the roofing systems shall be cleaned as recommended by the roofing manufacturer and shall be maintained in a clean condition until acceptance of the work by Owner.

- END OF SECTION -

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**SECTION 07 62 00**  
**SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall provide and install sheet metal flashing and trim, and appurtenant work, complete in place, in accordance with the Contract Documents.
- B. The scope of Work includes edge, eaves, and other trim, expansion joint covers, copings, prefinished sheet metal flashings, collards, pitch pockets (pans), equipment platforms (sleeper) support at all roof penetrations which are not provided as part of the roofing system, and all other components, mastic, sealants, and anchors necessary to make the structure weathertight.

**1.2 RELATED DOCUMENTS**

- A. Related work in other Sections includes but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 06 10 00 Rough Carpentry
  - 3. Section 07 32 00 Metal Roofing Systems
  - 4. Section 07 92 00 Joint Sealants

**1.3 REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 2. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - 3. ASTM A792 Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
  - 4. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
  - 5. ASTM C1311 Standard Specification for Solvent Release Sealants.
  - 6. ASTM D1187 Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
  - 7. ASTM D4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- C. Sheet Metal and Air Conditioning Contractors Association, SMACNA - Architectural Sheet Metal Manual

**1.4 PERFORMANCE REQUIREMENTS**

- A. Materials, anchorage, fastenings and workmanship shall qualify for U.L. Class 115 MPH (3 second gust) wind uplift rating.

- B. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and night time-sky heat loss.
  - 1. Temperature Change (Range): 120° F, ambient; 180° F, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

## **1.5 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Show materials, gauges, finishes, layout, joints, sizes, profiles and fasteners. Distinguish between shop- and field-assembled work. Include the following:
  - 1. Identify material, thickness, weight, and finish for each item and location in Project.
  - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
  - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Submit manufacturer's specifications, literature, and published installation and maintenance instructions for all sheet metal products.
- D. Provide samples of color where required.

## **1.6 QUALITY ASSURANCE**

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

## **1.8 COORDINATION**

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and noncorrosive installation.

## **PART 2 MATERIALS**

### **2.1 SHEET METAL**

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  - 1. Thickness 0.0239-inch (24 U.S. Standard gauge), unless shown otherwise.
  - 2. Finish-factory applied to match color of metal frames, or trim.
- B. Manufacturers shall be **Cheney Flashing Company, Fry Reglet Corporation, Heckmann Building Products, Inc.**, or approved equal.

### **2.2 DOWNSPOUTS, GUTTER AND TRIM**

- A. Downspouts, gutters and trim shall be same metal and thickness as roof panels. Fabricate gutters in minimum 96-inch long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from the same material as gutters. Fabricate expansion joints, expansion joints covers, gutter bead reinforcing bars, and gutter accessories from same material as gutters. Shop fabricate interior and exterior corners.
- B. Color shall match roof panels.

### **2.3 FASCIA AND RAKE TRIM**

- A. Fascia and rake trim shall be same metal and thickness as roof panels.
- B. Color shall match roof panels.

### **2.4 MISCELLANEOUS MATERIALS**

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
  - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating. Steel, galvanized per ASTM A153/A153M or stainless steel.

2. Fasteners for Flashing and Trim: Steel, galvanized per ASTM A153/A153M or stainless steel. Blind fasteners or self-drilling screws, gasketed, with hex washer head.
  3. Blind Fasteners: High-strength stainless-steel rivets.
- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, non-staining tape.
  - D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
  - E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
  - F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## **2.5 FABRICATION, GENERAL**

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.



1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual for application but not less than thickness of metal being secured.
- H. Reinforcement and Supports; Provide same material as flashing, unless other material is shown. Steel, where shown or required, shall be galvanized or stainless.
- I. Rigid Joints and Seams: make mechanically strong. Solder galvanized and stainless steel metal joints. Do not use solder to transmit stress.
- J. Provide watertight closures at exposed ends of counterflashing.

## **2.6 DOWNSPOUTS AND GUTTERS FABRICATION**

- A. Form downspouts and gutters in maximum lengths as practicable to sizes and shapes indicated on the Drawings.
  1. Lock longitudinal joints of downspouts.
  2. Telescope end joints 1-1/2 inches.
  3. Provide elbows at bottom where downspouts discharge onto splash blocks.
  4. Anchor downspouts with straps of same material as downspouts.
  5. Install gutters at locations indicated on drawings.

## **2.7 MISCELLANEOUS SHEET METAL FABRICATIONS**

- A. Equipment Support Flashing: Fabricate from the following material:
  1. Galvanized Steel: 0.028 inch thick.

## **2.8 FLEXIBLE BASE PIPE SEALS**

- A. Flexible base pipe seals shall be prefabricated on-piece aluminum flanged base with stepped, graduated EPDM profile which creates a compression seal between the piping and the flashing. Aluminum base shall be flexible to conform to profile of roof panels.
- B. Manufacturers and Products:
  1. Pate Co.; Dektite.
  2. Portals Plus, Inc.; Deck-Mate.
- C. Coat aluminum surfaces in contact with dissimilar metals in accordance with 3.2.B of this Section.
- D. Isolation tape shall be butyl or polyisobutylene, internally reinforced.
- E. Fasteners shall be stainless steel of type required.

## **2.9 FINISHES**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
  - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION, GENERAL**

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
  - 1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
  - 2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
  - 3. Use only stainless steel fasteners to connect isolated dissimilar metals.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and [elastomeric] [butyl] sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 30 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing

hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

G. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70° F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40° F.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 - "Joint Sealants."

H. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished Work.

1. Pre-tinning is not required for lead-coated copper.
2. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
3. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

### 3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
1. Secure in a waterproof manner by means of anchor and washer at 36-inch centers, or other method approved by ENGINEER.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Use appropriate flexible base pipe seal where pipe, conduit or cable, etc. penetrate roofing system.

2. Make work watertight and free of expansion and contraction noise. Seal and clamp flashing to pipes penetrating roof.

### **3.4 CLEANING AND PROTECTION**

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION -

**SECTION 07 92 00**  
**JOINT SEALANTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES:**

- A. Polyurethane Sealants
- B. Tape Mastic Sealants
- C. Non-skinning Sealants
- D. Silicone Sealants
- E. Acrylic Sealants
- F. Acoustic Sealants

**1.2 SECTION EXCLUDES:**

- A. Concrete joint sealants which are per Section 03 25 00.

**1.3 RELATED DOCUMENTS**

- A. Related Work in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures

**1.4 REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN ARCHITECTURAL MANUFACTURER'S ASSOCIATION (AAMA)
  - 1. AAMA 800-10 Voluntary Specifications and Test Methods for Sealants
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM A 792 Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
  - 3. ASTM C 639 Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
  - 4. ASTM C 661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
  - 5. ASTM C 681 Standard Test Method for Volatility of Oil- and Resin-Based, Knife Grade, Channel Glazing Compounds
  - 6. ASTM C 711 Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants

- |                 |   |
|-----------------|---|
| 7. ASTM C 794   | Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants   |
| 8. ASTM C 834   | Standard Specification for Latex Sealants   |
| 9. ASTM C 908   | Standard Test Method for Yield Strength of Preformed Tape Sealants  |
| 10. ASTM C 919  | Standard Practice for Use of Sealants in Acoustical Applications  |
| 11. ASTM C 920  | Standard Specification for Elastomeric Joint Sealants   |
| 12. ASTM D 56   | Standard Test Method for Flash Point by Tag Closed Cup Tester   |
| 13. ASTM D 217  | Standard Test Methods for Cone Penetration of Lubricating Grease  |
| 14. ASTM D 412  | Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension                                      |
| 15. ASTM D 792  | Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement                   |
| 16. ASTM D 925  | Standard Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)                      |
| 17. ASTM D 2452 | Standard Test Method for Extrudability of Oil- and Resin-Base Caulking Compounds  |
| 18. ASTM D 2453 | Standard Test Method for Shrinkage and Tenacity of Oil- and Resin Base Caulking Compounds                               |
| 19. ASTM D 1475 | Standard Test Method For Density of Liquid Coatings, Inks, and Related Products   |
| 20. ASTM D 2202 | Standard Test Method for Slump of Sealants  |
| 21. ASTM D 2203 | Standard Test Method for Staining from Sealants   |
| 22. ASTM E 84   | Standard Test Method for Surface Burning Characteristics of Building Materials  |
| 23. ASTM E 90   | Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements |
| 24. ASTM E 814  | Standard Test Method for Fire Tests of Penetration Firestop Systems   |
| 25. ASTM E 1966 | Standard Test Method for Fire-Resistive Joint Systems   |
| 26. ASTM G 154  | Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials       |

#### D. INTERIM FEDERAL SPECIFICATIONS (FS)

- |                    |  |
|--------------------|--|
| 1. FS TT-S-00230C  | Sealing Compound: Elastomeric Type, Single Component   |
| 2. FS TT-C-1796A   | Caulking Compounds, Metal Seam and Wood Seam   |
| 3. FS TT-S-001543A | Sealing Compounds: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures) |

#### E. SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

- |              |                                   |
|--------------|-----------------------------------|
| 1. Rule 1168 | Adhesive and Sealant Applications |
|--------------|-----------------------------------|

#### F. UNDERWRITER'S LABORATORIES (UL)

- |           |  |
|-----------|--|
| 1. UL 580 | Tests for Uplift Resistance of Roof Assemblies |
|-----------|--|

### 1.5 SUBMITTALS

- A. Provide Submittals in accordance with Section 01 33 00 Submittal Procedures.

- B. Material Safety Data Sheets (MSDS): Provide in accordance with 29 CFR 1910.1200,
- C. Hazard Communication
- D. Product Test Reports: Reports of tests required by this section performed by a qualified testing agency, indicating that the sealants comply with the requirements.
- E. VOC Content: Provide documentation of the Volatile Organic Content (VOC) in accordance with SCAQMD Rule 1168

## **1.6 WARRANTY**

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within 5 years of installation.

## **PART 2 PRODUCTS**

### **2.1 GENERAL MATERIAL REQUIREMENTS**

- A. Substrate Requirements: When testing is required on a substrate, the material used shall be either ASTM A653 G-90 or ASTM A792 AZ50 and tests shall be conducted with each of the following coatings:
  - 1. Bare (No coating)
  - 2. Acrylic (Galvalume Plus)
  - 3. Polyester
  - 4. Siliconized Polyester
  - 5. Polyvinylidene Fluoride Resin (PVDF)

### **2.2 POLYURETHANE SEALANT**

- A. General: Provide Sealants that meet the following specifications:
  - 1. ASTM C 920, Type S, Grade NS, Class 25, Use: NT, A, M, G and O paintable sealant
  - 2. AAMA 808.3
  - 3. FS TT-S-00230C, Type II, Class A
- B. Color: The sealant color shall be selected by OWNER.
- C. Physical Properties: The sealant shall have the following additional physical properties:
  - 1. Peel Adhesion: All panels shall have at least a 90% cohesive failure of at least 15 lb/in when tested in accordance with ASTM C 794.
  - 2. Tensile Strength: Sealant shall have a tensile maximum of 300 psi and an elongation of 500-600% when tested in accordance with ASTM D 412.
  - 3. Sag: There shall be no sag when tested in accordance with ASTM C 639.
  - 4. Hardness: Shore "A" hardness on all three samples shall not exceed 40 when tested in accordance with ASTM C 661
  - 5. Service Temperature Range: -40 degrees F to 200 degrees F.

6. Water Resistance: There shall be no presence of voids, cracks, separation or breakdown of the compound when tested in accordance with AAMA 800-10, Section 2.11.1.
7. Flash Point: No less than 145 degrees F when tested in accordance with ASTM D 56.
8. Shelf Life: The compound shall have a shelf life of 9 months or more when stored at or below 80 degrees.
9. Skin Time: The compound shall have a skin time of 2-4 hours
10. Cure Time: The compound shall have a cure time of 24-48 hours
11. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

## **2.3 TAPE MASTIC SEALANT**

- A. General: Provide Sealants that meet the following specifications:
  1. AAMA 804.3
  2. AAMA 807.3
  3. FS TT-C-1796A, Type II, Class B
  4. Approved by Underwriters Laboratories for use in roof deck constructions classified under UL-518 Class 90
- B. Color: The sealant color shall be selected by OWNER.
- C. Physical Properties: The sealant shall have the following additional physical properties:
  1. Specific Gravity: 1.4 or higher when tested in accordance with ASTM D 792
  2. Tensile Adhesive Strength: 20 psi or higher when tested in accordance with ASTM C 908
  3. Elongation: 1000% or higher when tested in accordance with ASTM C 908
  4. Cone Penetration: The sealant shall meet the following conditions when tested in accordance with ASTM D 217 with a 300g cone in 5 seconds:
    - a. 8.5 – 100 mm at 77 degrees F
    - b. 125-135 mm at 120 degrees F
    - c. 45-55 mm at Zero degrees F
  5. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

## **2.4 NON-SKINNING SEALANT**

- A. General: Provide sealants that meet the following specifications:
  1. AAMA 809.2
  2. FS TT-C-1796A, Type 1, Class A
- B. Color: The sealant color shall be selected by OWNER.
- C. Physical Properties: The sealant shall have the following additional physical properties:
  1. Extrudability: The sealant shall deposit in 30 to 50 seconds through a 0.104" orifice at 50 psi pressure in accordance with ASTM D 2452.



2. Total Solids: At least 85% by weight when determined in accordance with ASTM C 681.
3. Volume Shrinkage: Less than 15% when determined in accordance with ASTM D 2453.
4. Weight per U.S. Gallon: 10.75 lbs. +/- 0.25 lbs. when determined in accordance with ASTM D 1475.
5. Vehicle Bleed out: There shall be no visible exudation of vehicle from sealant after 21 days at 158 degrees F on the test panel.
6. Flexibility: There shall be no loss of adhesion at -60 degrees F when tested in accordance with ASTM C 711.
7. Sag: 0.20 in max, full button when tested in accordance with ASTM D 2202.
8. Staining: Sealant will not stain a painted test panel when tested in accordance with ASTM D 925, Method A.
9. UV Resistance: There shall be no cracking, bleeding, or loss of elasticity after 1,000 hours of QUV exposure in accordance with ASTM G 154.
10. Wet Flammability: No less than 110 degree F flash point when determined in accordance with ASTM D 56.
11. Coverage: Each gallon of sealant shall provide the following minimum coverage:
  - a. 500 lineal feet with 1/8-inch bead
  - b. 690 lineal feet with 3/16-inch bead
  - c. 390 lineal feet with 1/4-inch bead.
12. Shelf Life: 18 months minimum in unopened container when stored at or below 90 degrees F.
13. Drying time: Non-skinning, remains permanently soft and tacky.
14. Engageability: Sealant will easily engage and transfer to male joint at 10 degrees F.
15. Service Temperature Range: -60 degrees F to 200 degrees F.
16. Application Temperature Range: 10 degrees F to 120 degrees F.
17. Non-Reactive: Will not darken, etch, or leave salt deposits on the test panel after two years.
18. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

## **2.5 SILICONE SEALANT**

### **A. General: Provide sealants that meet the following specifications:**

1. ASTM C 920, Type S, Grade NS, Class 25
2. AAMA 802.3, Type I and II
3. AAMA 805.2 Group C
4. AAMA 808.3
5. FS TT-S-001543A, Class A
6. FS TT-S-00230C, Class A

### **B. Color: Clear**

### **C. Physical Properties: The sealant shall have the following additional physical properties:**

1. Mechanical Properties: The sealant shall have the following mechanical properties as determined by ASTM D 412:
  - a. Tensile Strength: 150 psi minimum (Method A)
  - b. Modulus at 100% Elongation: 35 psi minimum
  - c. Elongation: 400% minimum

- d. Recovery: 100%
- 2. Hardness: Maximum Shore A hardness of 15 when determined in accordance with ASTM C 661.
- 3. Tack-free Time: 1/4-inch diameter bead at 77 degrees F, 50% relative humidity, 10-15 minutes.
- 4. Cure Time: 1/4-inch diameter bead at 77 degrees F, 50% relative humidity, 10-12 hours.
- 5. Service Temperature: -60 degrees F to 300 degrees F.
- 6. Shelf Life: 9 months when stored in unopened original containers at 80 degrees F or less.
- 7. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

## **2.6 ACRYLIC SEALANT**

### **A. Color:**

- 1. Clear
- 2. White
- 3. Gray

### **B. Physical Properties:**

- 1. Percent Solids:
  - a. Colors: 75% minimum determined in accordance with ASTM D 1475
  - b. Clear: 70% minimum determined in accordance with ASTM D 1475
- 2. Peel Adhesion: All panels shall have at least a 90% cohesive failure of at least 5 lb/in when tested in accordance with ASTM C 794.
- 3. Weight per U.S. Gallon: 8.7 lbs. +/- 0.25 lbs. when determined in accordance with ASTM D 1475.
- 4. Viscosity: The sealant shall meet the following conditions when tested in accordance with ASTM D 2452 with a 20g cone with a 0.104-inch orifice at 60 psi at 77 degrees F in the indicated time:
  - a. Colors: 40-60 seconds
  - b. Clear: 35-45 seconds
- 5. Elongation: 200% minimum when tested in accordance with ASTM D 412.
- 6. Hardness: Maximum Shore A hardness of 55 when determined in accordance with ASTM C 661.
- 7. Flash Point: No less than the following when tested in accordance with ASTM D 56
  - a. Colors: 52 degrees F
  - b. Clear: 40 degrees F
- 8. Slump: 0.10" maximum when tested in accordance with ASTM D 2202.
- 9. Vehicle Migration: No vehicle migration from the sealant edge when tested in accordance with ASTM D 2203 as modified by Section 2.8.1 of AAMA 800-10.
- 10. Paintability: Compatible with Alkyds, enamels and lacquers post-solvent release.
- 11. Service Temperature Range: Zero degrees F to 180 degrees F.
- 12. Shelf Life: 18 months when stored in original, unopened containers at or below 80 degrees F.

## **2.7 ACOUSTIC SEALANT**

### **A. Color**

1. White
  2. Off-White
- B. Furnish and install an acrylic, latex-based sound caulk for use as a sealant in fire-rated partitions, smoke barriers and sound-rated assemblies that meets the following requirements:
1. ASTM C 834 specifications for latex sealants
  2. Surface-Burning Characteristics: Class A 5/0 (flame spread/smoke developed) or better in accordance with ASTM E 84.
  3. Solids: 73%  $\pm$  3% (minimum)
  4. ASTM E 90 (sound tests)
  5. ASTM E 1966 (fire-resistant joint systems)
  6. ASTM E 814 (through-penetration firestop systems)
- C. Manufacturer, or approved equal:
1. USG Sheetrock Brand, Acoustical Sealant
  2. Liquid Nails, AS-825
  3. Auralex Acoustics, Stop Gap

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install joint sealants in accordance with manufacturer's specifications and requirements.
- B. Install acoustical sealant in accordance with ASTM C 919.

- END OF SECTION -

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**SECTION 08 10 00**  
**DOORS, FRAMES, AND HARDWARE**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section covers all the work necessary to furnish and install the new doors, frames, and hardware, complete and operable.
- B. All doors and their pressed steel frames shall be steel, insulated, and the type and size as indicated on the Door Schedule on the Contract Drawings.

**1.2 RELATED WORK**

- A. Related work in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 09 90 00 Painting and Finishes

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
  - 1. ANSI A 115.IG Installation Guide for Doors and Hardware
  - 2. ANSI A 156.6 Standard for Architectural Door Trim
  - 3. ANSI A 156.16 Standard for Auxiliary Hardware
  - 4. ANSI A 250.8 SDI-100 Recommended Specifications for Standard Steel Doors and Frames
  - 5. ANSI A 250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
  - 6. ANSI A 250.11 Recommended Erection Instructions for Steel Frames
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 36 Standard Specification for Carbon Structural Steel
  - 2. ASTM A 108 Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished
  - 3. ASTM A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - 4. ASTM A 229 Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs
  - 5. ASTM A 653 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
  - 6. ASTM A 1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

7. ASTM A 1011 Standard 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
8. ASTM C 177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
9. ASTM D 256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
10. ASTM D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
11. ASTM D 790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
12. ASTM D 792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
13. ASTM D 882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting
14. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics
15. ASTM D 2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
16. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
17. ASTM E 90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
18. ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
19. ASTM E 413 Classification for Rating Sound Insulation

**D. AMERICAN WELDING SOCIETY (AWS)**

1. AWS D1.1 Structural Welding - Steel
2. AWS D1.3 Structural Welding Code – Sheet Steel

**1.4 SUBMITTALS**

- A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Manufacturer's catalog data and preprinted installation instructions of doors.
- C. A schedule showing the location of each door shall be included with the drawings. Submittal drawings shall include elevations of each door type, details and method of anchorage, details of construction, method of assembling sections, location and installation of hardware, shape and thickness of materials, details of joints and connections.
- D. Manufacturer's certificates that certify products meet or exceed the specified requirements.
- E. Warranty: Provide documentation of the manufacturer's standard written one (1) year warranty.

## 1.5 DELIVERY AND STORAGE

- A. Doors shall be delivered to the job site wrapped in a protective covering with the brands and names clearly marked thereon. Doors shall be stored in a dry location that is adequately ventilated and free from dust or water, and in a manner that permits easy access for inspection and handling. Doors shall be handled carefully to prevent damage to the faces, edges, and ends. Damaged items that cannot be restored to like-new condition shall be replaced.

## 1.6 MEASUREMENT AND PAYMENT

- A. There shall be no separate measurement and payment for doors, frames, and hardware. Full compensation for all doors, frames, and hardware shall be considered as included in the contract unit or lump sum bid prices for the various items of the Contract to which doors relate.

## PART 2 PRODUCTS

### 2.1 STEEL DOORS

- A. Steel doors and frames shall be of hollow metal construction and shall be full flush design with no visible seams. Interior and Exterior door face sheets shall be galvanized, hot-dip galvanized according to the requirements of ASTM A 653 with A60 finish. Manufacturers shall be **Republic Doors and Frames, Steelcraft, Ceco Door Products**, or approved equal. Doors shall conform to ANSI A 250.8 and to the following requirements:
  - 1. Hollow metal door, 1 3/4 inches thick flush type, constructed of two sheets of not less than stretcher leveled, 16-gauge steel sheets formed and welded for flush pan assembly, with internal 20-gauge vertical reinforcing channels spaced not over 8 inches on centers the full height of the door. There shall be no visible joints on the face of the doors. Reinforcing channels shall be uniformly spot welded to face plates at top and bottom of all doors. Filler channels shall be provided at the top and bottom of doors to provide a flush closure. The top of exterior doors shall be provided with flush, water- and weather-tight top enclosures.
  - 2. All interior void spaces shall be completely filled with EPS foam or polyurethane.
  - 3. Concealed sheet or bar steel reinforcement shall be provided for mortise type hardware. Reinforcing shall not be less than the following: 9-gauge for butts, 12-gauge for locksets and 14-gauge for surface applied hardware. Reinforcing shall be drilled and tapped to template requirements. Concealed reinforcing shall be provided for closures. Door bottom weather stripping shall be included to match thresholds.
  - 4. Door frames shall be pressed steel constructed of not less than 16-gauge steel and shall be of the shape indicated on the plans and as required to fit the various wall constructions. Frames shall be of welded unit construction assembled and welded in the shop. Welding shall be to a hairline joint with all exposed beads ground smooth.
  - 5. Concealed reinforcing of the frames for the mortise hardware shall be not less than the following: 3/16 inch for butts, 12-gauge for lock strike, 14-gauge for surface applied items and 18-gauge for plaster guards over mortised hardware reinforcement. Frames shall be mortised drilled and tapped to template requirements. Lock reinforcing units shall be supplied by finishing hardware supplier. Frames shall be anchored as shown in the drawings.
  - 6. Hinges shall be heavy duty ball bearing hinges with non-removable pins.

7. Pull plates shall be chrome plated or stainless steel and mounted on interior and exterior sides of all doors.
8. All double doors are to be supplied with a "Z" astragal of 14-gage steel for 1-3/4-inch doors and 16-gage for 1-3/8-inch doors.
9. Hardware including locksets and hinges shall be stainless steel.
10. Door Swing: All doors shall be installed with 160 to 180 degree swing except Door entering Electrical Room.

## 2.2 DOOR HARDWARE

- A. Trim material shall be stainless steel, unless noted otherwise.
- B. Pull Plates: 8" CTC pull, 4" x 16" plate, stainless steel, No. 110 x 70C by **Rockwood Mfg. Co.**, or approved equal, conforming to ANSI A 156.6.
- C. Hinges: satin stainless steel, 5 knuckles minimum, non-rising pin for interior doors and non-removable pin for exterior doors, number of hinges per door manufacturer's recommendation (minimum of 3 hinges per door). Where necessary to keep door leaf clear of walls, casings, jambs or reveals in door opening, wide throw hinges of an approved type shall be furnished. Finish shall be stainless steel satin (32D or 630). Manufacturer shall be **Mckinney T4A3386, Hager, Stanley Works FBB199 (32D)**, or approved equal.
- D. Cylinder Lock Set: Best Access Systems, Lockset 47H-7-AB-15-J-630-SH-S6-VT for exterior doors and 45H-7-N-15-M-630 for interior doors. Locks must be compatible with Owners existing keys. Contractor shall provide lock sets and keys that will match Owner's requirements. Lock set shall be ANSI A156.13, Series 1000, Grade 1 Operational, Strength, and Security.
- E. Lever Extension Flush Bolt, Upper, **Rockwood No. 555**, or approved equal, cadmium plated finish (inactive leaf only), conforming to ANSI A 156.16.
- F. Lever Extension Flush Bolt, Lower, **Rockwood No. 555**, or approved equal, cadmium plated finish (inactive leaf only), conforming to ANSI A 156.16.
- G. Threshold: **#277AS by Pemko Corporation**, or approved equal, raised interior, extruded aluminum threshold with neoprene seal.
- H. Drip Cap: Provide drip cap on all exterior doors. Drip cap shall be clear anodized aluminum, **Pemko 346C**, or approved equal.
- I. Door Closers: Door closers shall be full rack and pinion, cast iron, with adjustable regulators for closing and latching speed, back check and spring power. Closers shall be mounted for 180 degrees of swing whenever possible. All closers shall be LCN Model 4040XP with 4041-3071 DEL cylinder with extra duty hold open arm. Mounting plates shall be supplied as necessary. All door closers attached to mineral core or particle filled doors shall be installed with hex bolts. Cover shall be metal 4040XP-72MC with 689 Aluminum finish.
- J. Lock Strikes: Strikes shall have extended curved lips where required to protect trim from being marred by latch bolt. Strike lips shall not protrude more than 1/8-inch beyond door frame trim. Wrought box strikes shall be furnished on all locks, latches and deadlocks.



- K. Door Stop: Solid cast brass, DuraFlex bumper, **Rockwood #445**, or approved equal (Inactive leaf only)
- L. Non-Mortise Door Edge with Astragal: 0.06" thick stainless steel, **Rockwood HD306B-AST**, or approved equal (double doors only)
- M. Kick Plates: Unless otherwise indicated, kick plates shall be provided and shall be satin stainless 18-8, 18 gage, **Rockwood No. K1050F**, or approved equal.
- N. Weatherstripping and Seals: silicone gasketing, **Pemko S88D**, or approved equal.
- O. Door Bottom Sweep: stainless steel with neoprene seal, **Pemko 3151SSN**, or approved equal.

## 2.1 ACOUSTIC SOUND DOORS AND FRAMES

- A. **General:** Unless noted otherwise all doors shall be acoustic sound doors and frames. Sound retardant doors and frames shall be complete factory-built, and laboratory tested assemblies, complete with perimeter compression seals and automatic, door-bottom seals at sill. Assemblies shall be complete with metal frame, door(s), sealing system, and Cam-lift hinges.
- B. **Performance:** Sound retardant metal swinging door system shall be **Overly Model No. 5292185**, or approved equal, with a STC rating of 52 when tested as and operable system in accordance with ASTM E 90 and ASTM E 413.
- C. **Materials:** Sound doors and frames shall be constructed from formed sheet steel or structural shapes and bars. Sheet steel shall be commercial quality, level, cold rolled steel conforming to ASTM A 1008 or hot rolled, pickled, and oiled steel conforming to ASTM A 1011. Steel shapes shall comply with ASTM A 36 and steel bars with ASTM A 108, Grade 1018. Exterior and Interior units shall be fabricated from Galvannealed material conforming to ASTM A 653 (A60) with a coating weight of not less than 0.60 ounces per square foot.
- D. **Door Design:** Sound doors shall be a 1-3/4" nominal minimum thickness construction with sizes as indicated on the Contract Drawings. No visible seams shall be permitted on door faces. Face gauges, internal sound retardant core and perimeter door edge construction to be manufacturer's standard for the specified model. No lead or asbestos shall be permitted in door construction to achieve STC performance.
- E. **Frame Design:** Sound door shall be 14-gauge minimum welded units with integral trim and shipped with temporary spreader. Knock-down frames are not acceptable.
- F. **Cam Lift Hinges:** When required to achieve STC, manufacturer to furnish laboratory test data certifying hinges have been cycled a minimum of 1,000,000 while supporting a minimum door weight of 350 pounds.
- G. **Hardware Reinforcements:** Factory mortise, reinforce drill and tap and door and frames for all mortise hardware as required by hardware manufacturer's template. Provide necessary reinforcement plates as required for surface mounted hardware; all drilling and tapping to be done in field by installer. Provide dust cover boxes on all frame mortises.

- H. **Perimeter Seals:** Perimeter seals shall be made of sturdy vinyl with a magnetic tape insert. The hinge side shall be constructed to avoid pinching or other distortion of the seal from opening and closing the door.
- I. **Automatic Door Bottoms:** Automatic door bottoms shall close the entire gap between the door and the floor. The seal shall be 50 to 60 durometer neoprene, and the actuating mechanism shall compress or retract the seal properly when the outer face of the door is within 2-inches of the strike jamb.
- J. **Acoustic Threshold:** #2006STC by Pemko Corporation, or approved equal, raised interior, extruded aluminum threshold with neoprene seal.
- K. **Acoustic Door Bottom:** Pemko STC41, or approved equal, aluminum with black gasket.
- L. **Acoustic Astragal:** Acoustical Solutions Type #140, Krieger Specialty Products 341, or approved equal, aluminum with SBR seal.
- M. **Anchors:** Provide suitable anchors to properly install frames in walls. Frames in masonry walls shall have adjustable strap or wire anchors and headers and jambs must be fully grouted in the field.
- N. **Painting and Cleaning:** After fabrication of frames, all tool marks and surface imperfections shall be removed, and exposed faces of all welded joints dressed smooth. Chemically treat all surfaces to insure maximum paint adhesion and coat with a rust-inhibitive primer.

## 2.2 ACCESS DOORS AND FRAMES MISCELLANEOUS

- A. Fabricate doors and frames as shown on the drawings and in accordance with best shop practices. Frames shall be rigid, neat in appearance and free from defects. Field measurements shall be taken as required for coordination with adjoining work.
- B. Form exposed surfaces free from warp, wave, and buckle, with all corners square, unless otherwise shown. Set each member in proper alignment and relationship to other members with all surfaces straight and in a true plane.
- C. Reinforce members and joints with plates, tubes or angles for rigidity and strength.
- D. Doors and frames shall be mortised and reinforced for hardware in accordance with the hardware manufacturer's instructions and templates. The reinforcing shall be designed to receive hinges, locks, strikes, closures, etc.
- E. Mortar guard boxes shall be provided for hardware cutouts in frames.
- F. Furnish at least three (3) metal anchors or polymer spacers in each jamb of frames up to 84" high and one (1) additional anchor for each 24" in height above 84", in shapes, sizes and spacing shown or required for anchorage into adjoining wall construction. Fabricate joint anchor of stainless steel.
- G. Terminate bottom of frames at the indicated finished floor level.
- H. Provide clearance for doors of 1/8" at jambs and heads; 1/4" clearance above threshold.

- I. Where glazing is required, flush integral stops on one side and screw-on stops on the opposite side shall be provided.

## **2.3 FINISH**

- A. Surfaces shall be provided with a shop-primed galvanized finish. Prior to receiving primer, all surfaces shall be cleaned thoroughly and phosphate-treated to assure maximum paint adherence. Primer shall be a metallic oxide or synthetic resin primer of the manufacturer's standard type and shall be applied by dipping or spraying in accordance with ANSI A 250.10.
- B. Field painting of doors and frames shall be in accordance with Section 09 90 00 – Painting and Finishes. Finish coat shall be compatible with the shop applied primer coating.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions and in accordance with ANSI A 115IG. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be weather tight and shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.
- B. Access Door Frame Installation
  1. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged. Frame must not be drilled for brace supports as finish may be damaged. Install frames in accordance with ANSI A 250.11.
  2. Locate three (3) wall anchors per jamb at hinge and strike levels. Frames may be grouted full of mortar at jambs and anchors shall be built into the joints as walls are laid up. A continuous bead of silicone sealant is to be applied between the head and jamb at the miter joint.
- C. Adjust doors for free swing without binding. Adjust hinge sets, locksets, and other hardware. Lubricate using a suitable lubricant compatible with the door and frame coatings.
- D. Install work of this Section in strict accordance with approved shop drawings and manufacturer's recommended installation instructions. Where installations require field welding, all work must be performed by certified welders in accordance with AWS D1.1/D1.3.
- E. Upon installation, secure the services of a qualified representative of the manufacturer to visit the jobsite and inspect the complete installation of the door and frame assemblies, test all components thru a minimum of ten (10) cycles of operation and direct installer in correcting any non-conforming items found.

F. Remove temporary coverings. Repair or replace damaged installed products. Clean installed products in accordance with the manufacturer's instructions before acceptance by OWNER.

G. Clearances at edge of doors:

1. Between door and frame at head and jambs: 1/8 inch.
2. At meeting edges pairs of doors and at mullions: 1/8 inch.
3. At transom panels, without transom bars: 1/8 inch.
4. At sills without thresholds: 5/8-inch maximum above finish floor.
5. At sills with thresholds: 1/8-inch above threshold.

### 3.2 HARDWARE SCHEDULE

- A. The hardware schedule is arranged for convenience of locating hardware and does not preclude in any way the requirements that all necessary hardware shall be furnished and properly installed. Hardware not specifically called out shall be similar to that required for similar uses.
- B. Hardware equal in quality and utility will be accepted provided it conforms in operation, quality, weight, size, workmanship, and finish to the products hereinafter described. All component parts of locksets shall be the product of one manufacturer.

<b>Hardware Set 100 (Door 1 - Single Exterior Door)</b>				
Each to Receive:				
Cam Lift Hinge by Door/Frame Manufacturer				
Quantity	Item	Model No.	Finish	Manufacturer
1 each	Exit Devices	QED311- QET330-M	689	Stanley
1 each	Closer	4040XP	689	LCN
1 each	Kickplate	K1050F	630	Rockwood
1 each	Wall Stop	409	32D	Rockwood
3 each	Silencer	608	Gray	Rockwood
1 each	Threshold	2006STC	Alum	Pemko
1 each	Door Bottom	STC41	Alum	Pemko
1 each	Drip Cap	346C	Alum	Pemko
1 set	Perimeter Seal	S88D	Alum	Pemko
*Five Knuckle, Stainless Steel, Non-removal Pin Hinges (size and quantity by door manufacturer)				

<b>Hardware Set 200 (Door 2 – Double Exterior Door w/ Transom)</b>				
Each (of 2 Double Doors) to Receive: Cam Lift Hinge by Door/Frame Manufacturer				
Quantity	Item	Model No.	Finish	Manufacturer
1 each*	Lockset	47H-7-AB-15-M-630-S6-VT	630	Best Access Systems
1 each	Closer	4040XP	689	LCN
1 each	Kickplate	K1050F	630	Rockwood
1 each	Astragal	Type #140	630	Acoustical Solutions
1 each**	Flush Bolt, upper	555	626	Rockwood
1 each**	Flush Bolt, lower	555	626	Rockwood
1 each	Threshold	2006STC	Alum	Pemko
1 each	Door Bottom	STC41	Alum	Pemko
1 each	Drip Cap	346C	Alum	Pemko
1 set	Perimeter Seal	S88D	Alum	Pemko
* Deadbolt required on Active Leaf only				
** Inactive Leaf Only				
*** Cam lift hinges, stainless steel (size and quantity by door manufacturer)				

<b>Hardware Set 300 (Door 4 - Single Interior Door)</b>				
Each to Receive: Cam Lift Hinge by Door/Frame Manufacturer				
Quantity	Item	Model No.	Finish	Manufacturer
1 each	Lockset	45H-7-W-15-M	630	Best Access Systems
1 each	Closer	4040XP	689	LCN
1 each	Kickplate	K1050F	630	Rockwood
1 each	Wall Stop	409	32D	Rockwood
3 each	Silencer	608	Gray	Rockwood
1 each	Threshold	2006STC	Alum	Pemko
1 each	Door Bottom	STC41	Alum	Pemko
1 set	Perimeter Seal	S88D	Alum	Pemko
*Five Knuckle, Stainless Steel (size and quantity by door manufacturer)				

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**SECTION 08 33 23**  
**OVERHEAD COILING DOORS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section covers all the work necessary to furnish and install new overhead coiling doors, frames, motors, and hardware, complete and operable.

**1.2 RELATED WORK**

- A. Related work in other sections includes but is not limit to:

- |                     |                           |
|---------------------|---------------------------|
| 1. Section 01 33 00 | Submittal Procedures      |
| 2. Section 05 50 00 | Miscellaneous Specialties |
| 3. Section 09 90 00 | Painting and Finishes     |

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                |  |
|----------------|--|
| 1. ASTM A 653  | Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| 2. ASTM D 3363 | Standard Test Method for Film Hardness by Pencil Test  |
| 3. ASTM E 84   | Standard Test Method for Surface Burning Characteristics of Building Materials   |
| 4. ASTM E 90   | Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements          |

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

- |                |   |
|----------------|---|
| 1. ASHRAE 90.1 | Energy Standard for Buildings Except Low-Rise Residential Buildings |
|----------------|---|

D. American Society OF CIVIL ENGINEERS (ASCE)

- |           |   |
|-----------|---|
| 1. ASCE-7 | Minimum Design Loads for Buildings and Other Structures |
|-----------|---|

E. UNDERWRITERS laboratories (UL)

- |           |  |
|-----------|--|
| 1. UL 325 | Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems |
|-----------|--|

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.

- B. Manufacturer's catalog product data and preprinted installation instructions of doors.
- C. A schedule showing the location of each door shall be included with the shop drawings. Submittal drawings shall include elevations of each door type, details and method of anchorage, details of construction, wiring diagrams in motors are required, locations of louvers and glass if required, method of assembling sections, location and installation of hardware, shape and thickness of materials, details of joints and connections.
- D. Submit calculations stamped by a registered engineer showing connections are designed to meet code requirements and loads.
- E. Provide manufacturer and installer qualifications as noted below.
- F. Manufacturer's certificates that certify products meet or exceed the specified requirements.
- G. Submit operation and maintenance manual.

## **1.5 DELIVERY AND STORAGE**

- A. Doors shall be delivered to the job site wrapped in a protective covering with the brands and names clearly marked thereon. Doors shall be stored in a dry location that is adequately ventilated and free from dust or water, and in a manner that permits easy access for inspection and handling. Doors shall be handled carefully to prevent damage to the faces, edges, and ends. Damaged items that cannot be restored to like-new condition shall be replaced.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A minimum of five (5) years experience in producing doors of the type specified.
- B. Installer Qualifications: Installer must be approved or certified by the manufacturer.

## **1.7 WARRANTY**

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.

## **1.8 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for overhead coiling doors. Full compensation for all doors shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which doors relate.

# **PART 2 PRODUCTS**

## **2.1 OVERHEAR COILING DOORS**

- A. **General:** Overhead coiling doors (roll-up doors) shall be of the metal curtain slat design, motor operated, and shall be weather and dust-resistant. Wiring diagrams shall be submitted for motor operated doors. Doors shall be provided complete with slats,



guides, hoods, reduction gears, galvanized hand chain, operating mechanism, motors, controls, wiring, brackets, gears, head, bottom and side weather stripping, hardware, and other items necessary for complete installation and operation.

- B. **Wind Loading:** The doors shall be designed to withstand a wind load of 1115 MPH, Exposure B. Door shall also be designed to withstand 20 psf inward and 26 psf outward. Within 10 feet of corner inward pressure to be 33 psf and outward pressure to be 26 psf
- C. Air infiltration shall comply with ASHRAE 90.1 requirements of less than 1.0 CFM/SF.
- D. Cycle Life: Design doors of standard construction for normal use of up to 20 cycles per day maximum and an overall maximum of 50,000 operating cycles for the life of the door.
- E. Provide manufacturer's seismic calculations confirming ASCE 7-05.
- F. Manufacturer, or approved equal:
  - 1. Cookson Model TMWI
  - 2. Cornell Model ESD30
  - 3. Overhead Door Stormtite Series

## 2.2 MATERIALS

- A. **Curtain:** Shall have an air infiltration rate of less than 0.4 CFM/SF, validated by an independent testing agency.
  - 1. Fabrication:
    - a. Slat Material: No. 6F or 3/4 inch minimum by 2-1/2 inch minimum, (Listed Exterior/Interior):
      - 1) Galvanized Steel/Galvanized Steel: Manufacturer recommended gauge based on performance requirements. Minimum 24/24 gauge, Grade 40, ASTM A 653 galvanized steel zinc coating
    - b. Insulation: foamed-in-place, closed cell urethane. Insulation shall be CFC Free with an Ozone Depletion Potential (ODP) rating of zero.
    - c. Flame Spread Index of 5 and a Smoke Developed Index of 10 as tested per ASTM E 84
    - d. R-value: 7.7 minimum (U-value of 0.125) per ASHRAE.
    - e. STC Rating: Up to 30 for the curtain and up to 22 for the entire assembly, as tested per ASTM E 90 and based on testing a complete, operable assembly.
  - 2. Exterior and Interior Slat Finish:
    - a. ColorCote® (or equivalent) Coating System:
    - b. ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat.
    - c. Phosphate treatment followed by baked-on polyester powder coat, with color as selected by OWNER from manufacturer's standard color range; minimum 2.5 mils cured film thickness; ASTM D 3363 pencil hardness: H or better.

- B. **Endlocks:** Fabricate interlocking sections with high strength nylon or galvanized cast iron endlocks on alternate slats each secured with two 1/4 inch rivets. Provide windlocks as required to meet specified wind load.
1. **Nylon:** Required up to 21'-5" width (DBG - Distance Between Guides)
  2. **Galvanized cast iron:** Required if above 21'-5" width (DBG - Distance Between Guides)
- C. **Insulated Bottom Bar:** Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge. Minimum 4" tall x 1-1/16" thickness.
1. Finish:
    - a. Exterior: Match slats
    - b. Interior: Powder coat to match slats
  2. Air Infiltration Certification Label: Must be affixed to bottom bar
- D. Guides:
1. Fabrication:
    - a. Thermal break required: Minimum 3/16 inch stainless steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.
  2. Finish:
    - a. Stainless Steel: Type 304 #4 Finish
- E. Counterbalance Shaft Assembly:
1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
  2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.
- F. Brackets: Fabricate from minimum 3/16 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
1. Finish: Hot-dip galvanized per ASTM A 123, Grade 85 zinc coating. Hot-dip galvanize after fabrication.
- G. Hood: Minimum 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch steel intermediate support brackets as required to prevent excessive sag.
1. Finish:
    - a. ColorCote® (or equivalent) Coating System:

- 1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat.
- 2) Phosphate treatment followed by baked-on polyester powder coat, with color as selected by OWNER from manufacturer's standard color range; minimum 2.5 mils cured film thickness; ASTM D 3363 pencil hardness: H or better.

#### H. Weather Stripping:

1. Bottom Bar:
  - a. Manually Operated Doors: Replaceable, bulb-style, compressible EDPM gasket extending into guides.
  - b. Motor Operated Doors: Sensing/weather edge with neoprene astragal extending full width of door bottom bar
2. Guides: Replaceable vinyl strip on guides sealing against both sides of curtain.
3. Lintel Seal: Nylon brush seal fitted at door header to impede air flow.
4. Hood: Neoprene/rayon baffle to impede air flow above coil.

## 2.3 OPERATION

- A. **Manual Chain Hoist:** Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide. Fabricate gear box to completely enclose operating mechanism and be oil-tight.
- B. **Motor Operator:** The operator must not extend above or below the door coil when mounted front-of-coil. Rated for a maximum of 20 cycles per hour (not to be used for consecutive hours) UL listed, Totally Enclosed Non-Ventilated gear head operator(s) rated 1/2 hp min, or larger, as recommended by door manufacture for size and type of door, 480 Volts, Three Phase, 60 Hz. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist, and control station. Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged.

A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided. Operator shall be capable of driving the door at a speed of 8 to 9 inches per second.

Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions. The motor-operated doors, motors, controls, safety devices, and wiring shall conform to requirements of governing codes and authorities. Motor operator shall be **Cookson Model SG, Cornell Model MG, Overhead Door Model RHX**, or approved equal.

- C. Control Station: "Open/Close" key switch with "Stop" push button in a NEMA 3R enclosure.
- D. Control Operation:
  - 1. Momentary Contact to Close, Fail-safe UL 325 Compliant entrapment protection for motor operation; 2-wire, E.L.R. electric sensing/weather edge extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position.
  - 2. Sensing/Weather Edge: Automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar.
    - a. Electric sensing edge device. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.

## **2.4 ACCESSORIES**

- A. Locking: For non-motor operated doors, provide a master keyable cylinder operable from both sides of bottom bar, options for all types of operation. Cylinder shall be BEST 7-pin.
- B. Vision Panels: 10 x 1-1/2 x 3/4 inch thick oval acrylic panes set with double-sided foam glazing tape and fully contained within slat assembly. Refer to drawings for number and placement. Smaller vision panels are not acceptable.
- C. Operator and Bracket Mechanism Cover: If the operator components are lower than 8 feet above finish floor level, provide Minimum 0.040 inch aluminum sheet metal cover to enclose exposed moving operating components at coil area of unit.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of work by installer is acceptance of substrate.

### **3.2 INSTALLATION**

- A. General: Install overhead coiling door and operating equipment with necessary hardware, anchors, inserts, hangers, and supports in accordance with the manufacturer's installation instructions.
- B. Doors and frames shall be accurately cut, fitted, and installed level, square, plumb, and in alignment. Fasteners shall be of sufficient length and shall be sized for loads imposed.
- C. Installation of motor operators shall be in accordance with the manufacturer's installation instructions and as required by Division 26.

### **3.3 ADJUSTING**

- A. Following completion of installation, including related work by others, lubricate, test, and adjust the doors for ease of operation, free from warp, twist, or distortion.

### **3.4 CLEANING**

- A. Clean surfaces soiled by work as recommended by the manufacturer.
- B. Remove surplus materials and debris from the site.

### **3.5 DEMONSTRATION**

- A. Demonstrate proper operation to OWNER's Representative.
- B. Instruct OWNER's Representative in maintenance procedures.

- END OF SECTION -

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**SECTION 08 62 00**  
**SKYLIGHTS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section covers all the Work necessary to furnish and install skylights, complete and in place.

**1.2 RELATED WORK**

- A. Related work in other Sections includes but is not limited to:
1. Section 01 33 00 Submittal Procedures
  2. Section 09 90 00 Painting and Finishes

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.
- B. AMERICAN ARCHITECTURAL MANUFACTURER'S ASSOCIATION (AAMA)
1. AAMA 1606 Voluntary Uniform Load Structural Standard for Plastic Domed Skylights
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A 123 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
  2. ASTM B 221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  3. ASTM D 256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
  4. ASTM D 4802 Standard Specification for Poly (Methyl Methacrylate) Acrylic Plastic Sheet

**1.4 PERFORMANCE REQUIREMENTS**

- A. General: Provide unit skylights capable of withstanding loads indicated without failure. Failure includes the following:
1. Thermal stresses transferred to the building structure.
  2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing.
  3. Noise or vibration created by thermal and structural movement and wind.
  4. Weakening of fasteners, attachments, and other components.

- B. Structural Loads: Provide unit skylights that meet the requirements of AAMA 1606-82, which requires acrylic thickness adequate to withstand a positive and negative test pressure of 60 PSF.

## **1.5 SUBMITTALS**

- A. Provide Submittals in accordance with Section 01 33 00 Submittal Procedures.
- B. Product Data Sheet: For each type of skylight specified, include details of construction and installation, relative to applicable roofing materials, materials, gauges, sizes, finishes, and fasteners.
- C. Samples for Selection: Manufacturer's color charts showing a full range of colors available for each type of skylight glazing and Aluminum Finish.

## **1.6 DELIVERY AND STORAGE**

- A. Skylights shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon.

## **1.7 WARRANTY**

- A. Manufacturer shall provide to the Owner written guarantee against defects in material or workmanship for a period of five (5) years.

## **1.8 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for skylights. Full compensation for all skylights shall be considered as included in the contract unit or lump sum bid prices for the various items of the Contract to which they relate.

# **PART 2 PRODUCTS**

## **2.1 SKYLIGHTS**

- A. Skylights shall be as noted on the drawings and be manufactured by **Wasco Products, Inc., Aladdin Industries**, or approved equal. Skylights shall be factory assembled with square double-dome type designed to meet applicable OSHA and building code requirements. Skylights shall be watertight with curb frame insulation and meet the requirements specified herein. All hardware shall be stainless steel throughout. Skylights shall be provided with a permanent label showing the manufacturer's name and address and the model number.
  - 1. Curb Frame: High performance PVC with minimum effective thickness of 0.60 inch. Provide integral condensation gutter with corners fully welded for waterproof quality.
  - 2. Retainer Frame: Extruded aluminum alloy 6063-T5 (min) conforming to ASTM B 221 with minimum effective thickness of 0.60 inch.
  - 3. Integral Curbs (Where indicated): Fabricated from double skin of 1100-H14 sheet aluminum, insulated with 1-inch fiberglass insulation. Provide thermal break at top and bottom. Provide minimum 0.025 inch minimum thickness inner and outer skin. Outer skin to be 0.032 inch when length exceeds 48 inches.



4. Plastic Sheets: Monolithic, formable, transparent (colorless – Clear) with good weather and impact resistant.
  - a. Acrylic: Conforming to ASTM D 4802, thermoformable, acrylic (methacrylate), Category C-2 or CC-2 Type UVA (formulated with ultraviolet absorber), with Finish 1 (smooth or polished), unless otherwise indicated. Average impact strength of 5.0 ft-lb/in when tested per ASTM D 256 (Charpy unnotched).
  - b. Impact Modified Acrylic: Conforming to ASTM D 4802, thermoformable, acrylic (methacrylate) impact modified sheets manufactured by the extrusion process, category C-2 or CC-2, type UVA (formulated with ultraviolet absorber) with Finish 1 (smooth or polished). Average impact strength of 0.75 ft-lb/inch (40 J/m of notch) when tested according to ASTM D 256, Test Method A (Izod).
5. Thermal Break: Fabricate skylight units with thermal barrier separating interior metal framing from materials exposed to outside temperature.
6. Shape and Size: As indicated by model number.
7. Fasteners: Same material as metals being fastened or non-magnetic stainless steel as recommended by the manufacturer.

## 2.2 SKYLIGHT SCREENS

- A. All skylights that do not meet OSHA and building code requirements for opening protection shall be provide with skylight screens. Screens shall be designed to meet OSHA regulation 29 CFR 910.23(e)(8) and shall meet the code requirements for opening protection. The entire assembly and anchoring system shall be designed and tested to withstand a minimum impact load of 300 foot pounds.
- B. Screens shall be hot-dip galvanized, 3-inch by 4-inch welded wire mesh with a minimum diameter of 0.195-inch. Galvanizing shall conform to ASTM A 123.
- C. Screens shall be manufactured by **Wasco Products, Inc., Aladdin Industries, Plasteco, Inc.**, or approved equal.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Skylights shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, skylights shall be weather tight and shall be free from warp, twist, or distortion.
- B. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape as recommended by the manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by the manufacturer.

- C. Coordinate with installation of the roof deck and other substrates to receive skylights. Coordinate vapor barriers, roof insulation, roofing material, and flashing as required to assure that each element of the work performs properly and that combined elements was waterproof and watertight. Anchor units securely to supporting structure substrates to adequately withstand lateral and thermal stresses as well as inward and outward loading pressures.
- D. Where counter flashing is required as a component of the skylight, install to provide adequate waterproof overlap with roofing or roof flashing. Seal with a thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

- END OF SECTION -

**SECTION 09 20 00**  
**GYPSUM BOARD**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall provide gypsum board and appurtenances, complete and in place, as shown on the Contract Drawings and in accordance with the specifications.

**1.2 RELATED WORK**

- A. Related Work in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 60 00 Product Requirements
3. Section 09 90 00 Painting and Finishes

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

- B. American Society for Testing and Materials (ASTM)

1. ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products
2. ASTM C 475 Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
3. ASTM C 754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
4. ASTM C 840 Standard Specification for Application and Finishing of Gypsum Board
5. ASTM C 919 Standard Practice for Use of Sealants in Acoustical Applications
6. ASTM C 920 Standard Specification for Elastomeric Joint Sealants
7. ASTM C 1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
8. ASTM C 1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
9. ASTM C 1178 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
10. ASTM C 1280 Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
11. ASTM C 1325 Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
12. ASTM C 1396 Standard Specification for Gypsum Board
13. ASTM C 1629 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
14. ASTM C 1658 Standard Specification for Glass Mat Gypsum Panels
15. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

- 16. ASTM E 72      Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
- 17. ASTM E 84      Standard Test Method for Surface Burning Characteristics of Building Materials
- 18. ASTM E 90      Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- 19. ASTM E 96      Standard Test Methods for Water Vapor Transmission of Materials
- 20. ASTM E 119      Standard Test Methods for Fire Tests of Building Construction and Materials
- 21. ASTM E 136      Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
- 22. ASTM E 814      Standard Test Method for Fire Tests of Penetration Firestop Systems
- 23. ASTM G 21      Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

C. American National Standards Institute (ANSI)

- 1. ANSI A 108.11      Specifications for Interior Installations of Cementitious Backer Units
- 2. ANSI A 118.9      Test Methods and Specifications for Cementitious Backer Units

D. Gypsum Association (GA)

- 1. GA-214      Recommended Levels of Finish – Gypsum Board, Glass Mat & Fiber-Reinforced Gypsum Panels
- 2. GA-216      Application Finishing Gypsum Panel Products
- 3. GA-234      Control Joints for Fire-Resistance Rated Systems
- 4. GA-253      Application of Gypsum Sheathing
- 5. GA-600      Fire Resistance Design Manual

E. Wall and Ceiling Bureau (WCB)

- 1. TB-52010      Control Joints for Gypsum Board

## 1.4 SUBMITTALS

- A. CONTRACTOR shall submit documents per the requirements of Section 01 33 00 Submittal Procedures.
- B. Submit manufacturer's literature, product data sheets, and installation instructions for plaster and gypsum products and appurtenances to be used in the Work.

## 1.5 DELIVERY AND STORAGE

- A. Delivery, storage, and handling of gypsum products shall be in accordance with Section 01 60 00 – Product Requirements, the manufacturer's printed instructions, and as indicated below.
- B. Manufactured materials shall be delivered in original unbroken packages, containers, or bundles, bearing the manufacturer's label.

- C. Verify products undamaged before acceptance at the Project Site. Do not use products with visible signs of mold and damage.
- D. Storage
  - 1. Store the materials in an area that is protected from the elements as recommended by the manufacturer.
  - 2. Storage shall be in a manner that will prevent damage to the material and its finish.
  - 3. Materials shall be stored above ground in a dry and ventilated space,
  - 4. Boards that will be directly applied to masonry walls shall be stored at 70 degrees F for 24 hours prior to installation.

## **1.6 PROJECT CONDITIONS**

- A. Do not install gypsum board when the ambient temperature is below 40 degrees F.

## **1.7 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for plaster and gypsum board. Full compensation for plaster and gypsum board shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which it relates.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS OR APPROVED EQUAL:**

- A. National Gypsum Company
- B. United States Gypsum Company (USG Corporation)
- C. Georgia Pacific Corporation
- D. Certainteed (a Saint-Gobain Company)

### **2.2 ACOUSTICALLY ENHANCED GYPSUM BOARD**

- A. Performance Criteria – Wall Assembly STC: (wood stud construction) 52 (metal stud construction 55).
- B. Attach gypsum board to furring channels hung from **KNC “Wave Hanger” Acoustic System.**
- C. Panel Physical Characteristics
  - 1. Core
    - a. Inner Layer: Viscoelastic damping polymer
    - b. Outer layers: Enhanced, high density mold-resistant gypsum core
  - 2. Overall thickness: 5/8 inch, Type X
  - 3. Long Edges: Tapered
  - 4. Mold Resistance:
    - a. 10 when tested in accordance with ASTM D 3273
    - b. 0 when tested in accordance with ASTM G 21

5. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C 1629
6. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629
7. Soft Body Impact Resistance: Classification Level 2 in accordance with ASTM C 1629
8. Hard Body Impact Resistance: Level 1 in accordance with ASTM C 1629
9. Environmental Requirements: Provide products that comply with testing and product requirements for low emitting materials

## **2.3 ACCESSORY PRODUCTS**

### **A. Acoustical Sealant**

1. Conform to ASTM C 919
2. VOC content less than 15 g/L
3. Manufacturer, or approved equal:
  - a. Grabber Acoustical Sealant GSCS
  - b. USG Acoustical Sealant
  - c. STI SpecSeal Smoke N Sound Caulk
  - d. BOSS 824 Acoustical Sound Sealant

### **B. Firestopping**

1. Conform to ASTM E 90
2. Manufacturer, or approved equal:
  - a. STI SpecSeal SSP Putty Pads
  - b. USG Firecode Smoke-Sound Sealant
  - c. 3M Fire Barrier Moldable Putty Pads MPP+
  - d. BOSS 818 Fire Rated Putty Pads

### **C. Metal trim, corner beads, edge, casing beads, and accessories shall be manufactured from galvanized sheet steel unless noted otherwise.**

## **2.4 FASTENERS**

### **A. General: Fastener screws shall be of the self-drilling, self-tapping, bugle head type for use with power tools, with a length as recommended by the Gypsum Association referenced standards and in accordance with the local Building Code.**

1. Types:
  - a. Type "S" for board-to-sheet metal application
  - b. Type "W" for board-to-wood application
  - c. Type "G" for board-to-board application
  - d. Type "S" or "S-12", for tile backing board-to-metal studs application

## **2.5 TAPE**

### **A. General: Joint reinforcing tape shall conform to ASTM C 475 and ASTM C 840.**

### **B. Tape:**

1. Paper Tape: 2- 1/16 inches wide, **ProForm Joint Tape – Heavy, USG Heavy Joint Tape, CertainTeed Marco Spark-Perf 94# Heavy Weight**, or approved equal.
2. Fiberglass Mesh Tape: Nominal 2-inch wide self-adhering tape, **ProForm Fiberglass Mesh Tape, FibaTape Drywall Joint Tape**, or approved equal.

## 2.6 JOINT COMPOUND

- A. General: Joint compound shall conform to ASTM C 475.
- B. Drying Type Compound:
  1. Ready Mix vinyl base compound, **ProForm All Purpose Ready Mix Joint Compound, USG All Purpose Joint Compound - Select, CertainTeed All Purpose**, or approved equal.
  2. Ready Mix vinyl base compound formulated for enhanced mold and mildew resistance, **ProForm XP Ready Mix Joint Compound, CertainTeed Mold Resistant Lite All-Purpose**, or approved equal, conforms to ASTM D 3273
  3. Ready Mix vinyl base topping compound for finish coating, **ProForm Topping Compound, CertainTeed Topping, USG Topping Joint Compound**, or approved equal
  4. Ready Mix vinyl base compound for embedding joint tape, cornerbeads or other accessories, **ProForm Taping Joint Compound, CertainTeed Heavy Taping Joint Compound, USG Ready-Mixed Taping Joint Compound**, or approved equal
  5. Field Mix vinyl base compound, **ProForm Triple-T Compound**, or approved equal
- C. Setting Compound:
  1. Field mixed hardening compound, **ProForm Quick Set Setting Compound, USG Durabond Setting-Type Compound**, or approved equal
  2. Field mixed hardening compound for fire resistance rated construction and penetrations, **ProForm Fire Shield 90, USG Firecode Compound**, or approved equal, conforms to ASTM E 136 and ASTM E 814.
  3. Field mixed hardening compound for mold and moisture resistance, **CertainTeed M2Tech 90 Setting Compound**, or approved equal.
- D. Joint Sealant
  1. Joint sealants shall conform to ASTM C 920
  2. Joint sealants shall have VOC content less than 2 g/L

## 2.7 ACCESS PANELS

- A. Provide access panels where indicated or where required for access to valves and equipment
- B. Standard access panels: flush installation type, grey powder coated steel, double-acting concealed spring hinges, screw type lock, **Milcor Type DW, KARP Model KDW**, or approved equal.
- C. Acoustical access panel: recessed panel, with screw type lock, **Milcor Type AP**, or approved equal.

- D. Fire rated access panel: UL listed, self-closing, self-latching, **Milcor Type UFR**, or approved equal.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Provide gypsum board over framing and furring members.
- B. Gypsum board installation and fire-rated gypsum board construction shall conform to applicable codes, reference standards, manufacturer's printed recommendations, the Gypsum Association's recommendations, and the following requirements:
  - 1. Gypsum board shall be applied first to the ceiling and then to the walls.
  - 2. Fastening
    - a. Gypsum board shall be screwed to metal framing and furring.
    - b. The fastener spacing shall be in accordance with the referenced standards.
    - c. Do not attach gypsum board to metal roof decking.
  - 3. The gypsum wall board surface finish shall be as indicated below.
  - 4. The installation of the steel framing shall be in accordance with ASTM C 754 and code requirements.

### **3.2 EXAMINATION**

- A. Verify installation conditions are satisfactory to receive work of this Section before beginning.
- B. Verify framing systems, including backing, insulation, vapor barriers, and other systems ready for work of this Section.
- C. Do not begin work until building envelope is fully enclosed and temperature, ventilation, and humidity are controlled.
- D. Do not begin work under conditions that gypsum board installation may be exposed to contact with water.

### **3.3 PREPARATION**

- A. Protect surrounding areas and surfaces to preclude damage.
- B. Avoid soiling, spatter, and damage to work of other trades. Use cover cloths, or other means of protection. Remove, clean, and repair soiled or damaged work.

### **3.4 INSTALLATION**

- A. Conform to ASTM C 840, GA-216, and manufacturer's instructions.
- B. Corner Trim: Reinforce external corners with specified corner beads.
- C. Edge Trim: Install square edged metal trim bead at exposed edges and boundaries of areas where abutting dissimilar materials.
- D. Reveal Trim:



1. Install with screws at 12 inch on center in 10 foot lengths, except where shorter lengths are sufficient for dimension of wall plane.
  2. Make butt joints tight and in alignment.
  3. Miter corners.
  4. Promptly remove excess joint compound.
- E. Control Joints: Conform to WCB TB-52010 and GA-234, except as otherwise indicated. Verify that required double framing is in place before installing control joints.
1. Door and Other Openings: Install control joints at each side of wall opening and at both sides of wall, except alcoves and similar wall configurations.
  2. Continuous Wall Planes: Install control joints floor to ceiling at each 30 lineal foot of wall.
  3. Ceilings: Install across ceiling at each 50 lineal foot distance and each 2,500 square foot of ceiling area.
  4. Joints with Other Materials: Install where gypsum board meets masonry, concrete, and other materials, except where joints are concealed under horizontal chair rails or other trim.
- F. Other Trim: Install as indicated or required for complete and finished installation.
- G. Panel Joints:
1. Layout: Design to reduce joints to minimum.
  2. Install board in maximum lengths to minimize horizontal and vertical joints.
  3. Start installation of panels at exterior wall to position butt joints as far away from exterior wall as possible.
  4. Place edges in contact and fit neatly, without forcing into place.
  5. Stagger joints on opposite sides of partitions and on same side of wall surface at adjacent joints.
  6. Maintain 1/2 inch clearance from bottom of wall panel and top of floor. Seal with acoustical sealant.
  7. In order to prevent wicking of moisture, do not let gypsum board rest on floor after installation.
- H. Single Layer Systems: Install in accordance with ASTM C840. Where modified, amended, or required by fire resistive or sound isolation system, conform to the requirements of the manufacturer's tests, as approved.
- I. Double Layer Systems: Install in accordance with ASTM C840, including System VIII for double layer gypsum wallboard installations applied with screws. Conform to required fire resistance standards.
- J. Joint Sealant and Acoustical Sealant: Install to completely fill void between wallboard edges and adjacent surface.
- K. Firestopping and Smoke Sealants: Install in accordance with manufacturer's recommendations.
- L. Plumbing, HVAC, and Electrical: Coordinate work with other Divisions. Provide for installations and penetrations of ductwork, equipment, receptacles, and other work.

### 3.5 TOLERANCES

- A. Shim panels as necessary to conform to tolerances.
- B. Between Board Faces: 1/16 inch offset.

### 3.6 ADJUSTING

- A. Remove and replace the following gypsum board installations:
  - 1. Board in contact with water for over 18 hour time period
  - 2. Gypsum core exhibiting dampness or water intrusion
  - 3. Facing paper exhibiting delamination
  - 4. Facing of core exhibiting mold growth or turning black
  - 5. Board sagging or warped
  - 6. Board directly exposed to water determined to be contaminated

### 3.7 CLEANING

- A. Clean beads, screeds, metal base, metal trim, mechanical and electrical items, and other work.
- B. Wipe clean, leaving work ready for finish specified under other Sections.
- C. As work is completed in each space, clean all rubbish, utensils, and surplus materials from the space. Leave floors broom-clean.

### 3.8 SURFACE FINISH

- A. Gypsum board joints shall be taped, and joints, end trim, corner beads, fasteners, and other depressions shall be treated with joint and finishing compounds, applied in accordance with the manufacturer's printed recommendations for Level 4 Finish (3-coat work) according to ASTM C 840 and the table below.
- B. The gypsum board shall be sanded smooth, dusted, and provided with a smooth finish coat.

### 3.9 PAINTING

- A. The surface shall be painted in accordance with Section 09 90 00 Painting and Finishes.

LEVEL OF FINISH	
Finish Level	Description
Level 0	No taping, finishing or corner beads are required.
Level 1	All joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges shall be acceptable.
Level 2 (1-coat work)	All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife or trowel leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound.

	Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
Level 3 (2-coat work)	All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife or trowel leaving a thin coating of joint compound over all joints and interior angles. One additional coat of joint compound shall be applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compounds shall be smooth and free of tool marks and ridges. The prepared surface shall be covered with a drywall primer prior to the application of the final decoration.
Level 4 (3-coat work)	All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife or trowel leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints. One separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compounds shall be smooth and free of tool marks and ridges. The prepared surface shall be covered with a drywall primer prior to the application of the final decoration.
Level 5 (3-coat work)	All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife or trowel leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints. One separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound shall be trowel-applied to the entire surface. Excess compound is immediately sheared off, leaving a film of skim coating compound completely covering the paper. As an alternate to a skim coat, a material manufactured especially for this purpose shall be applied. The surface shall be smooth and free of toll marks and ridges.

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**SECTION 09 84 13**  
**FIXED SOUND-ABSORPTIVE PANELS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall provide fixed sound absorbing acoustical wall panels with mounting brackets, low-frequency stand-offs, and other components as required, complete and in place, as shown on the Contract Drawings and in accordance with the specifications. Install panels only on Pump Room interior walls up to 8-feet above the floor except at doors. Panels are not required against shared wall with Electric Room.
- B. Acoustical panels and components shall be modular and demountable. All panel connections shall allow easy disassembly and reassembly with no degradation of acoustical or mechanical performance. All components of like function and size shall be interchangeable.

**1.2 RELATED WORK**

- A. Related work in other sections includes but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 01 60 00 Product Requirements
  - 3. Section 09 90 00 Painting and Finishes

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM)
  - 1. ASTM C 411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
  - 2. ASTM C 423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - 3. ASTM C 665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
  - 4. ASTM C 1104 Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation
  - 5. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
  - 6. ASTM E 795 Standard Practices for Mounting Test Specimens During Sound Absorption Tests
- C. National Fire Protection Association (NFPA)
  - 1. NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

D. Underwriters Laboratories (UL)

1. UL 723                      Standard for Test for Surface Burning Characteristics of Building Materials

**1.4 SUBMITTALS**

- A. CONTRACTOR shall submit documents per the requirements of Section 01 33 00 Submittal Procedures.
- B. Submit manufacturer's literature, product data sheets, and installation instructions for fixed sound-absorptive panels and appurtenances to be used in the Work.
- C. Submit show drawings showing the locations, layout, and sizes of fixed sound-absorptive panels to be installed.

**1.5 DELIVERY AND STORAGE**

- A. Delivery, storage, and handling of sound panels and products shall be in accordance with Section 01 60 00 - Product Requirements, the manufacturer's printed instructions, and as indicated below.
- B. Manufactured materials shall be delivered in original unbroken packages, containers, or bundles, bearing the manufacturer's label.
- C. Verify products undamaged before acceptance at the Project Site. Do not use products with visible signs of mold and damage.
- D. Storage
  1. Store the materials in an area that is protected from the elements as recommended by the manufacturer.
  2. Storage shall be in a manner that will prevent damage to the material and its finish.
  3. Materials shall be stored above ground in a dry and ventilated space,

**1.6 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for fixed sound-absorptive panels. Full compensation for fixed sound-absorptive panels shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which it relates.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS OR APPROVED EQUAL:**

- A. Industrial Noise Control, Inc. (INC) – Panl-Sorb
- B. Acoustical Solutions - AlphaPerf

## **2.2 MATERIALS**

- A. Panels shall be 2-inch thick consisting of a one-piece formed perforated panel body filled with acoustical sound absorbing material.
- B. Steel Materials: All steel used in the panel construction shall be galvanized coated. Standard panels are electro-galvanized (EG) and may be painted without chemical wash. G-90 hot dipped galvanized, aluminum, or stainless steel used when specified.
- C. Perforated Panel Body: Shall be 22-gauge EG sheet perforated to an effective open area of 33% using 0.093-inch diameter holes on 0.156-inch staggered centers. Panel body shall be fully perforated and formed on the long edges to provide additional 13% additional absorptive surface.
- D. Mounting Channels: Shall be 18 gauge formed with smooth rolled or hemmed edges with pre-punched mounting holes.
- E. Absorptive Fill: Shall be 2-inch thick by 1.5 lb. minimum density fibrous sound absorbing material. Insulation shall meet ASTM C 423 Sound Absorption Coefficient of NRC-1.00. Insulation shall exhibit the following properties:
  - 1. Odor: None
  - 2. Corrosiveness (ASTM C 665): Does not accelerate corrosion on steel, copper, or aluminum
  - 3. Resistance to Fungi or Bacteria: Does not promote growth of fungi or bacteria and shall be mold and vermin resistant.
  - 4. Water Vapor Sorption (ASTM C 1104): Less than 0.01% by volume
  - 5. Temperature Resistance (ASTM C 411): Will not deteriorate up to +1200°F.
- F. Fill Protection: Panel fill shall be totally encapsulated using a 1.5 mil polyethylene film. Wrap shall be separated from the panel perforated skin with a polyethylene web mesh spacer. Metal spacers, chicken wire, etc., are not acceptable.

## **2.3 CONSTRUCTION**

- A. Panel Size: 30-inch standard panel width available to 42-inch width by 12-foot maximum length.
- B. Module Thickness: 2-inch standard units
- C. Panel Body: Shall be one-piece formed construction. Spot welded or otherwise assembled panel shells are not acceptable.
- D. Internal Panel Reinforcement: When specified, an internal 22 gauge steel reinforcement channel shall be inserted to provide additional panel rigidity.

## **2.4 FINISH**

- A. All components shall be supplied with a baked polyester powder coat finish in standard white color.

- B. All components shall be properly cleaned and degreased, and be free of blemishes prior to applying the coating system.

## **2.5 PANEL ACOUSTICAL PERFORMANCE**

- A. All metal faced acoustical panels shall exhibit the following Sound Absorption Characteristics as tested and documented by an independent, accredited test laboratory in accordance with ASTM C 423 and E 795.

	Minimum Absorption Data by Octave Band Frequency (Hz)						
Mounting	125	250	500	1000	2000	4000	NRC
Flush	0.20	0.59	1.18	1.23	1.16	1.22	1.05

## **2.6 FIRE RATING**

- A. Standard panels shall meet ASTM E 84 Class I Smoke & Fire Standards
- B. Panel acoustical fill shall meet the following
  - 1. Surface Burning Characteristics (ASTM E84, NFPA 255, & UL 723):
    - a. Flame Spread = 10
    - b. Smoke Developed = 10

## **2.7 MANUFACTURER EXPERIENCE AND CERTIFICATIONS**

- A. The manufacturer shall have designed and produced a standard pre-engineered system meeting the specifications stated herein for a minimum of 10 years.
- B. The manufacturer warrants that when the panels and components are assembled in strict accordance with its specifications and instructions, that the resulting completed structure shall meet the intended mechanical and acoustical performance specified for the project.
- C. Products shall be warranted for a period of one year from the date of shipment against any defects in workmanship or materials.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Fixed sound-absorptive panels shall be installed after the ceiling gypsum board has been installed and painted.
- B. Fixed sound-absorptive panels shall be installed to cover approximately **40% to 45%** of the wall space inside the pump room.

### **3.2 INSTALLATION**

- A. Fixed sound-absorptive panels shall be installed according to the manufacturer's printed instructions.



- B. Panels shall be installed level and plum.

### **3.3 CLEANING**

- A. Wipe panels clean after completion of installation.
- B. As work is completed in each space, clean all rubbish, utensils, and surplus materials from the space.

### **3.4 PAINTING**

- A. The surface shall be painted in accordance with Section 09 90 00 Painting and Finishes.

- END OF SECTION –

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**SECTION 09 90 00**  
**PAINTING AND FINISHES**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section covers furnishing, surface preparation, and applying paints and coatings, complete and in place, to all specified surfaces including exposed valves, piping or fittings.
- B. Definitions
  - 1. The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
  - 2. The term "DFT" means minimum dry film thickness, without any negative tolerance.
  - 3. The term "mil" means thousandths of an inch.
  - 4. The term "SSPC" means The Society for Protective Coatings.
- C. The following surfaces shall not be coated:
  - 1. Concrete, unless required by items on the concrete coating schedule below or the Drawings.
  - 2. Stainless steel
  - 3. Machined surfaces
  - 4. Grease fittings
  - 5. Glass
  - 6. Equipment nameplates
  - 7. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.
- D. The protective coatings applicator (Applicator) shall possess a valid state license as required for the performance of the painting and coating work called for in this specification and shall provide 5 references which show the Applicator has previous successful experience with the indicated of comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the Applicator provided the protective coating.

**1.2 RELATED WORK**

- A. Related Work in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 09 98 10 Pipeline Linings and Coatings
  - 3. Section 33 05 05 Ductile Iron Pipe
  - 4. Section 33 11 10 Miscellaneous Appurtenances
  - 5. Section 33 92 10 Steel Pipe, Specials, and Fittings

### 1.3 REFERENCES AND STANDARDS

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

1. OSHA Occupation Safety and Health Act: State of Utah and Federal
2. ICRI International Concrete Repair Institute Guideline No. 310.2 –  
Selecting and Specifying Concrete Surface Preparation for  
Sealers, Coatings, and Polymer Overlays

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI A 13.1 Standard for Scheme for the Identification of Piping Systems
2. ANSI Z 535 Standard for Safety Colors

C. AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

1. ASTM C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
2. ASTM D 520 Standard Specification for Zinc Dust Pigment
3. ASTM D 521 Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
4. ASTM D 6943 Standard Practice for Immersion Testing of Industrial Protective Coatings Linings
5. ASTM D 1653 Standard Test Methods for Water Vapor Transmission of Organic Coating Films
6. ASTM D 2370 Standard Test Method for Tensile Properties of Organic Coatings
7. ASTM D 2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
8. ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
9. ASTM D 4414 Standard Practice for Measurement of Wet Film Thickness by Notch Gages
10. ASTM D 4417 Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
11. ASTM D 7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
12. ASTM D 7682 Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty
13. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
14. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
15. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 210 Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
2. AWWA C 222 Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings

E. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 301                      Specifications for Structural Concrete

F. NACE International (NACE)

1. NACE RP0287      Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
2. NACE SP0188      Standard Practice for Discontinuity (Holiday) Testing of Protective Linings
3. NACE SP0892      Standard Practice for Coatings and Linings over Concrete for Chemical Immersion and Containment Service
4. NACE No. 1/SSPC-SP 5 White Metal Blast Cleaning
5. NACE No. 2/SSPC-SP10 Near White Metal Blast Cleaning
6. NACE No. 3/SSPC-SP6 Commercial Blast Cleaning
7. NACE No. 6/SSPC-SP13 Surface Preparation of Concrete

G. SSPC: The Society for Protective Coatings (SSPC)

1. SSPC PA1 - Shop, Field, and Maintenance Painting of Steel
2. SSPC-PA2 – Paint Application Specification No. 2: Measurement of Dry Coating Thickness with Magnetic Gages.
3. SSPC-PA11 - Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating
4. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.
5. SSPC-SP10/NACE 2 - Near White Metal Blast Cleaning
6. SSPC-SP16 – Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
7. SSPC-VIS 1 - Guide to Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

## 1.4 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. CONTRACTOR shall supply shop drawings for approval on all paint materials at least 30 days prior to installation. Submittals shall include the following data sheets:
  1. For each paint system used herein, furnish a Paint System Data Sheet (PSDS), Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system, except for products applied by equipment manufacturers.
- C. Where ANSI/NSF 61 approval is required, submit ANSI/NSF 61 certification letter for each coating in the system indicating the product application limits on size of tank or piping, dry film thickness, number of coats, specific product tests, colors certified, and approved additives.
- D. Quality Control Submittals:
  1. Furnish a list of references for the Applicator substantiating the requirements as specified.

2. Manufacturer's certification stating factory applied coating systems meets or exceeds requirements specified herein.
3. If the manufacturer of finish coating differs from that of shop primer, provide both manufacturers' written confirmation that materials are compatible.

## **1.5 PAINT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver paint to the project site in unopened containers that plainly show, at the time of use, the designated name, date of manufacture, color, and name of manufacturer.
- B. Store paints in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by the manufacturer.

## **1.6 QUALITY ASSURANCE**

- A. All inspection for quality assurance shall ultimately be the responsibility of CONTRACTOR. OWNER retains the right to observe, accept, or reject the work based on the results of CONTRACTOR's inspection or observations by ENGINEER, at OWNER's discretion, in accordance with the specifications.
- B. Repair and recoat all runs, overspray, roughness, or any other signs of improper application in accordance with paint manufacturer's instructions and as reviewed by ENGINEER.
- C. Observations by OWNER or ENGINEER, or the waiver of inspection of any particular portion of the work, shall not be construed to relieve CONTRACTOR of his responsibility to perform the work in accordance with these specifications.

## **1.7 MANUFACTURER'S SERVICES**

- A. Furnish paint manufacturer's representative to visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

## **1.8 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS**

- A. An inspection may be conducted during the eleventh month following completion of coating work. CONTRACTOR and a representative of the coating material manufacturer shall attend this inspection. Defective work shall be repaired in accordance with these specifications and to the satisfaction of OWNER. OWNER may, by written notice to CONTRACTOR, reschedule the inspection to another date within the one-year correction period or may cancel the inspection altogether. CONTRACTOR is not relieved of its responsibilities to correct defects whether or not the inspection is conducted.

# **PART 2 PRODUCTS**

## **2.1 GENERAL**

- A. CONTRACTOR shall use suitable coating materials as recommended by the manufacturer. Materials shall comply with Volatile Organic Compound (VOC) limits applicable at the Site.

- B. Where manufacturers and product numbers are listed, it is to show the type and quality of coatings that are required. If a named product does not comply with VOC limits in effect at the time of Bid opening, that product will not be accepted, and CONTRACTOR shall propose a substitution product of equal quality that does comply. Proposed substitute materials will be considered as indicated below. Coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.
- C. In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.
- D. Colors and shades of colors of coatings shall be as indicated or selected by ENGINEER. Each coat shall be of a slightly different shade to facilitate observation of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by OWNER.
- E. Substitute or "Or-Equal" Products
  - 1. Basis of Design: The Coating Systems listed below in paragraph 2.3 are based on products from Tnemec Company Incorporated, except where indicated below.
  - 2. Product Substitution: To establish equality under Section 01 60 00 – Product Requirements, the specified coating systems are the minimum standard of quality for this project. Equivalent materials of other manufacturers may be substituted only by approval of ENGINEER. Requests for material substitutions shall be in accordance with requirements of the project specification.
  - 3. Product Requirements: CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or equal" product that the material meets the indicated requirements and is equivalent or better in the following properties: Quality, Durability, Resistance to abrasion and physical damage, Life expectancy, Ability to recoat in the future, Solids content by volume, Dry film thickness per coat, Compatibility with other coatings, Suitability to chemical attack, Temperature limitations during application and in service, Type and quality of recommended undercoats or topcoats, Ease of repairing damaged areas, and stability of colors.
  - 4. Manufacturers of "or equal" products shall provide direct performance comparison with the materials specified, in addition to complying with all other requirements of these Specifications. "Or equal" products shall employ the same generic type materials and system components as the specified coating systems.
  - 5. Requests for product substitution shall be made and approved at least 10 days prior to bid date.
  - 6. CONTRACTOR shall bear any additional costs, if a proposed substitution requires changes or additional work.

## **2.2 COLORS**

- A. Provide colors as selected by OWNER or ENGINEER.
- B. Colors shall be formulated with colorants free of lead, lead compounds, or other materials which might be affected by the presence of hydrogen sulfide or other gas likely to be present at the project.

- C. Proprietary identification of colors is for identification only. Any authorized manufacturer may supply color matches.
- D. Equipment colors;
1. Equipment shall mean the machinery or vessel itself plus the structural supports and fasteners.
  2. Paint non-submerged portions of equipment in the same color as the process piping it serves, except as indicated below:
    - a. Dangerous parts of equipment and machinery: OSHA Orange
    - b. Fire protection equipment and apparatus: OSHA Red
    - c. Radiation hazards: OSHA Purple
    - d. Physical hazards in normal operating area: OSHA Yellow
  3. Fiberglass reinforced plastic (FRP) equipment with an integral colored gel coat does not require painting, provided the color is as specified.
- E. Piping color coding shall be in accordance with ANSI A13.1, Division of Drinking Water R-309-525, and International Plumbing Code.
1. Color code non-submerged metal piping except electrical conduit. Paint fittings and valves the same color as the pipe unless otherwise specified.
  2. Pipe supports: If pipe supports are not galvanized or stainless steel, supports shall be painted ANSI No. 70 light gray as specified in ANSI Z535.
  3. Fiberglass reinforced plastic (FRP) pipe and polyvinyl chloride (PVC) pipe located outside of buildings and enclosed structures will not require painting, unless noted otherwise on the Drawings.

## 2.3 COATING SYSTEMS

### A. System No. 1 Steel – Immersion Potable Water NSF 61 Certification

#### 1. Materials

Type	Epoxy conforming to AWWA C 210 and D 102 (for steel tanks).
VOC content, max, g/L	250
Volume Solids, min, %	67
Demonstrated Suitable for	Long term immersion in water, resistant to corrosion, good color retention
Certification	NSF 61 if in contact with potable water

#### 2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
SSPC-SP10 Near-White Blast Cleaning with	Primer: Tnemec 140 Pota-Pox Plus Intermediate: Tnemec 140 Pota-Pox Plus Finish: Tnemec 140 Pota-Pox Plus	Primer: 3-5 DFT Intermediate: 4-6 DFT Finish: 4-6 DFT



minimum angular profile of 1.5 mils	Primer: Sherwin Williams Tank Clad HS Intermediate: Sherwin Williams Tank Clad HS Finish: Sherwin Williams Tank Clad HS	
	Primer: Carboline Carboguard 891 VOC Intermediate: Carboline Carboguard 891 VOC Finish: Carboline Carboguard 891 VOC (For AWWA C210 only)	

### 3. Application

- a. For use on the interior and exterior (submerged items only) of steel surge tanks, pipes, valves, pumps, equipment in potable water service including concrete embedded surfaces of metallic items under submerged conditions, such as wall pipes, pipes, pipe sleeves, casings, and structural steel, except reinforcing steel.

### B. System No. 2 Steel – Immersion Non-Potable Water (NOT USED)

### C. System No. 3 Steel – Interior Exposed

#### 1. Materials

Type	Polyamide Epoxy
VOC content, max, g/L	250
Volume Solids, min, %	67
Demonstrated Suitable for	Ferrous, galvanized, surfaces in industrial exposure, resistant to mild corrosion and chemical fumes, has good color and gloss retention
Certification	None

#### 2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
Ferrous Metal: SSPC-SP6 Commercial Blast Cleaning with a minimum angular anchor profile of 1.5 mils  Galvanized and Non-Ferrous: SSPC-SP16 with a minimum angular anchor profile of 1.5 mils	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 69 Hi-Build Epoxoline II	Primer: 3-5 DFT Finish: 4-6 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams Macropoxy 646 Fast Cure Epoxy	
	Primer: Carboline Carboguard 60 Finish: Carboline Carboguard 60	

### 3. Application

- a. All exposed metal surfaces located inside of structures.
- 4. Special Requirements
  - a. The surface preparation and primer shall be shop applied to all surfaces prior to installation. Finish coats need only be applied to the surfaces exposed after completion of construction.

D. System No. 4 Steel – Exterior Exposed (NOT USED)

E. System No. 5 Buried Steel Pipe – See Specification Section 09 98 10 Pipeline Linings and Coatings.

F. System No. 6 Steel – Doors and Frames

1. Materials

Type	Modified Polyamidoamine Epoxy with Aliphatic Acrylic Polyurethane (topcoat)
VOC content, max, g/L	250
Demonstrated Suitable for	Interior and Exterior Industrial, Architectural, and Commercial applications

2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
SSPC-SP2/SP3 Hand and Power Tool Cleaning; feather rough edges; remove loose rust, dirt, and other contaminants with sandpaper	Primer: Tnemec Series 135 Chem-Build Finish: Tnemec Series 1095 Endura-Shield	Primer: 3-5 DFT Finish: 3-5 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams HS Polyurethane 250	
	Primer: Carboline Carboguard 60 Finish: Carboline Carbothane 133LV(Satin) or 134VOC(Gloss)	

- 3. Application
  - a. Factory primed steel doors and frames
  - b. Exterior and Interior steel in corrosive and non-immersion environments.
  - c. Maintenance of existing marginally prepared rusty steel and tightly adhering old coatings.

G. System No. 7 Galvanized Steel and Cast/Ductile Iron – Exterior Exposed

1. Materials

Type	Polyamide Epoxy with Aliphatic Acrylic Polyurethane (topcoat)
VOC content, max, g/L	250

Demonstrated Suitable for	Ferrous, galvanized, nonferrous, cast/ductile iron surfaces in industrial exposure, highly resistant to abrasion, wet conditions, corrosive fumes, and exterior weathering
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## 2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
<p>Galvanized Steel and Non-Ferrous: SSPC-SP16 brush-off blast cleaning of coated and uncoated galvanized steel and non-ferrous metals to achieve a uniform anchor profile of 1.0-2.0 mils.</p> <p>Ductile and Cast Iron: Prepare all surfaces as per NAPF 500-03 - Uniformly abrasive blast the entire exterior surface using abrasive to an NAPF 500-03-04 with a minimum angular anchor profile of 1.5 mils.</p>	<p>Primer: Tnemec Series 69 Hi-Build Epoxoline II</p> <p>Finish: Tnemec Series 1095 Endura-Shield</p>	<p>Primer: 3-5 DFT</p> <p>Finish: 2.5-4 DFT</p>
	<p>Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy</p> <p>Finish: Sherwin Williams HS Polyurethane 250</p>	
	<p>Primer: Carboline Carboguard 890</p> <p>Finish: Carboline Carbothane 133LV(Satin) or 134VOC(Gloss)</p>	

## 3. Application

- a. Exposed galvanized and cast/ductile iron surfaces located outside of structures requiring painting and the following specific surfaces unless noted otherwise:

- 1) All exposed galvanized pipe
- 2) All exposed cast/ductile iron pipe

## H. System No. 8 Galvanized Steel and Cast/Ductile Iron – Interior Exposed

### 1. Materials

Type	Polyamide Epoxy
VOC content, max, g/L	250
Demonstrated Suitable for	Ferrous, galvanized, nonferrous, cast/ductile iron surfaces in industrial exposure, resistant to mild corrosion and chemical fumes, has good color and gloss retention

## 2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
Galvanized Steel and Non-Ferrous: SSPC-SP16 brush-off blast cleaning of coated and uncoated galvanized steel and non-ferrous metals to achieve a uniform anchor profile of 1.0-2.0 mils. Ductile and Cast Iron: Prepare all surfaces as per NAPF 500-03 - Uniformly abrasive blast the entire exterior surface using abrasive to an NAPF 500-03-04 with a minimum angular anchor profile of 1.5 mils.	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 69 Hi-Build Epoxoline II	Primer: 3-5 DFT Finish: 3 – 5 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams Macropoxy 646 Fast Cure Epoxy	
	Primer: Carboline Carboguard 60 Finish: Carboline Carboguard 60	

## 3. Application

- a. Exposed galvanized and cast/ductile iron surfaces located inside of structures requiring painting and the following specific surfaces unless noted otherwise:
  - 1) All exposed galvanized pipe
  - 2) All exposed cast/ductile iron pipe
- b. Do not paint galvanized steel mechanical pipe and equipment supports unless noted otherwise.

I. System No. 9 Concrete Floors – Light Traffic, Low Impact (NOT USED)

J. System No. 10 Concrete Floors – Chemical Exposure (NOT USED)

K. System No. 11 – Gypsum Wallboard and Plaster

### 1. Materials

Type	Waterborne Epoxy/Acrylic Polymer
VOC content, max, g/L	175/94
Demonstrated Suitable for	long term protection in both interior/exterior exposures

## 2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
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Sand joint compound smooth and feather edge. Clean and dry.	Primer: Tnemec Elasto-Grip FC Series 151-1051 Intermediate: Tnemec Enduratone Series 1028 Finish: Tnemec Enduratone Series 1028	Primer: 0.7-1.5 DFT Intermediate: 2-3 DFT Finish: 2-3 DFT
	Primer: Carboline Sanitile 120 Intermediate: Carboline Carbocrylic 3359 Finish: Carboline Carbocrylic 3359	

### 3. Application

a. Interior gypsum wallboard and plaster on walls and ceilings.

L. System No. 12 – Concrete Walls and Concrete Masonry Units, Interior – Not Exposed to Chemicals (NOT USED)

M. System No. 13 – Concrete Walls and Concrete Masonry Units, Interior – Exposed to Chemicals (NOT USED)

N. System No. 14 Concrete – Concrete Exposed to Severe Wastewater (NOT USED)

O. System No. 15 Wood, Interior Exposed

### 1. Materials

Type	Acrylic
VOC content, max, g/L	50
Demonstrated Suitable for	Wood trim and plywood sheathing in pump stations and similar municipal water and wastewater facilities.

### 2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
Surface Preparation: Sand rough areas, Clean and Dry	Primer: Sherwin Williams Multi-purpose Interior-Exterior Latex Primer-Sealer Intermediate: Sherwin Williams Pro-Industrial Acrylic Coating Finish: Sherwin Williams Pro-Industrial Acrylic Coating	Primer: 0.7-1.5 DFT Intermediate: 2-3 DFT Finish: 2-3 DFT
	Primer: Tnemec Series 51-1051 Elasto-Grip Intermediate: Tnemec Series 1026 EnduraTone Finish: Tnemec Series 1026 EnduraTone	
	Primer: Carboline Sanitile 120	

	Intermediate: Carboline Carbocrylic 3359 Finish: Carboline Carboguard 3359	
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3. Application
  - a. Trim and plywood sheathing

## 2.4 SPECIAL COATING SYSTEMS – INCLUDING FOR BURIED PIPING

- A. System 200 - PVC Tape: Prior to wrapping the pipe with PVC tape, the pipe and fittings first shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half-lapped, to a total thickness of 40 mils. PVC Tape wrap buried pipe where indicated on the Drawings.
- B. System 201 – Water Retardant, Concrete and Masonry

### 1. Materials and Coating System

Type	Silane-modified siloxane
Demonstrated suitable for	Repelling water from vertical concrete and masonry surfaces
VOC Content, g/L, max	250
Products, or approved equal	TAMMS Barracade M.E./9 Rainguard Blok-Lok Tnemec Dur A Pell 20 Series 636

### 2. Preparation

- a. Surface cracks, holes, or other imperfections in concrete surfaces only that exceed 1/64 of an inch shall be filled with pointing mortar. Masonry joints found to be unsound, hollow, or otherwise defective shall be raked out to a depth of 1/2 inch and pointed with mortar.
- b. Remove loose particles and foreign matter. Remove oil or foreign substance with a cleaning agent which will not affect the coating.
- c. Scrub and rinse surfaces with water, and let dry.
- d. Protect adjacent surfaces not scheduled to receive coating and landscaping, property and vehicles from over spray and drift.
- e. Concrete shall cure a minimum of 28 days before application.
- f. Apply coating per manufacturer's recommendations and instructions.

### 3. Application

- a. Exterior concrete walls of pump station

- C. System 202 – **Polyethylene Encasement is required for all buried Ductile Iron Pipe:** Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C. Provide polyethylene encasement where indicated on the drawings or per Section 30 05 05 – Ductile Iron Pipe.

- D. System 203 – Ductile or Cast-Iron, Valves and Gates - Immersion in Water and Wastewater

## 1. Materials

Type	High Solids Epoxy
VOC content, max, g/L	285
Demonstrated Suitable for	Ductile or Cast-Iron immersion in water or wastewater
Certification	NSF 61 if used for immersion in potable water

## 2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
Prepare all surfaces by uniformly abrasive blasting the entire exterior surface to ensure cleanliness and to create a minimum angular anchor profile of 2.0 mils.	Primer: Tnemec Hi-Build Epoxoline II Series N69 <sup>(1)</sup> Intermediate: Tnemec Hi-Build Epoxoline II Series N69 <sup>(1)</sup> Finish: Tnemec Hi-Build Epoxoline II Series N69 <sup>(1)</sup>	Primer: 3 - 5 DFT Intermediate: 4 - 6 DFT Finish: 4 - 6 DFT
	Primer: Ameron Amerlock 400 Intermediate: Ameron Amerlock 400 Finish: Ameron Amerlock 400	
	Primer: International Interseal 670 HS Intermediate: International Interseal 670 HS Finish: International Interseal 670 HS	
	Primer/wastewater: Carboline Phenoline 1205 Finish/wastewater: Carboline Phenoline 1205	
	Prime (NSF61): Carboline Carboguard 635VOC Intermediate (NSF 61): Carboline Carboguard 635VOC Finish (NSF 61): Carboline Carboguard 635VOC	
	<sup>(1)</sup> For NSF 61 certified potable water applications use Tnemec Pota-Pox Plus Series N140.	

## 3. Application

- a. Exterior coating on pump bowls

### 2.5 CONCRETE FINISHES

- A. Exterior Above Grade Concrete: Concrete surfaces exposed to view outside the building and including 6 inches below finished grade on the building or structure should be finished with a "Class B" finish. Products for the "Class B" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

- B. Interior Exposed Above Floor Concrete: Interior above grade concrete shall be finished with a "Class B" finish. Products for the "Class B" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.
- C. Interior Concrete Floors: Interior concrete floors shall be finished with a "Trowel" finish. Products for the "Trowel" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.
- D. Exterior Concrete Flat Surfaces: Exterior concrete flat surfaces shall be finished with a "Broom" finish. Products for the "Broom" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. The intention of this specification is for all new, interior and exterior, masonry, concrete, and metal, whether atmospheric or submerged exposure surfaces to be painted whether specifically mentioned or not, except as modified herein. Concealed structural steel surfaces shall receive a prime coat only unless modified herein.
- B. Surface preparation and coating application shall be in accordance with these specifications and the coating manufacturer's written product data sheets and written recommendations of the manufacturer's technical representative. Where conflict occurs between the manufacturer's recommendations and these specifications, the more stringent of the two shall apply unless approved by ENGINEER.
- C. For immersion coatings, obtain full cure for completed system before immersing or allowing exposure to water of condensation for more than 12 hours.

### **3.2 REGULATORY REQUIREMENTS**

- A. Meet federal, state, and local requirements limiting the emission of volatile organic compounds and worker exposures.
- B. Protect workers and comply with applicable federal, state, and local air pollution and environmental regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, coating application, and dust prevention including but not limited to the following Acts, Regulations, Standards, and Guidelines:
  - 1. Clean Air Act
  - 2. National Ambient Air Quality Standard
  - 3. Resource Conservation and Recovery Act (RCRA)
  - 4. SSPC Guide 6
- C. Comply with applicable federal, state, and local regulations for confined space entry.
- D. Provide and operate equipment that meets explosion proof requirements.

### **3.3 ENVIRONMENTAL CONDITIONS**

- A. Do not apply paint in extreme heat, temperatures below 40 degrees F, nor in dust, smoke-laden atmosphere, damp or humid weather. The Applicator shall adhere to the



manufacturer's recommendations regarding environmental conditions. The Applicator shall monitor humidity, air temperature, and surface temperature with properly calibrated instruments.

- B. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, nor whenever surface temperature is less than 5 degrees F above dew point of ambient air. Strictly adhere to manufacturer's recommendations.
- C. Surface preparation power tools and blast equipment shall contain dust collection devices that will prevent discharge of dust particles into the atmosphere around electrical or mechanical equipment unless otherwise permitted by ENGINEER.
- D. Where weather conditions or project requirement dictate, the Applicator shall provide and operate dehumidification equipment to maintain environmental conditions suitable for abrasive blasting and coating application as specified.

### **3.4 WORKMANSHIP**

- A. Skilled craftsmen and experienced supervision shall be used on coating work.
- B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough surface preparation. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given so that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.
- C. Damage to other surfaces resulting from the work shall be cleaned, repaired, and refinished to original condition.

### **3.5 STORAGE, MIXING, AND THINNING OF MATERIALS**

- A. Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for other procedures relative to coating shall be strictly observed.
- B. Coating materials shall be used within the manufacturer's recommended shelf life.
- C. Coating materials shall be stored under the conditions recommended by the Product Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings from different manufacturers shall not be mixed together.

### **3.6 SURFACE PREPARATION**

- A. All surfaces which receive paint or other coatings shall be prepared in accordance with the recommendations of the manufacturer of the material being used. The Applicator shall examine surfaces to be coated and shall correct surface defects before application of any coating material. Marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any field coating application.

- B. Perform sandblasting for piping and any other items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, and procedures shall meet requirements of the Society for Protective Coatings (formerly the Steel Structures Painting Council).

### **3.7 PROTECTION OF MATERIALS NOT TO BE PAINTED**

- A. Surfaces that are not to receive coatings shall be protected during surface preparation, cleaning, and coating operations.
- B. Remove, mask or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
- C. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- D. Protect working parts or mechanical and electrical equipment and motors from damage.
- E. Care shall be exercised not to damage adjacent work during blasting operations. Spraying shall be conducted under carefully controlled conditions. CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blasting or coating operations.

### **3.8 SURFACE PREPARATION STANDARDS**

- A. The following referenced surface preparation specifications of the the Society for Protective Coatings shall form a part of this specification:
  - 1. Solvent Cleaning (SSPC SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.
  - 2. Hand Tool Cleaning (SSPC SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
  - 3. Power Tool Cleaning (SSPC SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.
  - 4. White Metal Blast Cleaning (SSPC SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
  - 5. Commercial Blast Cleaning (SSPC SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.
  - 6. Brush-Off Blast Cleaning (SSPC SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.
  - 7. Near-White Blast Cleaning (SSPC SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.
  - 8. Surface Preparation of Concrete (SSPC-SP13): Removal of protrusions, laitance and efflorescence, existing coatings, form-release agents, and surface contamination by detergent or steam cleaning, abrasive blasting, water jetting, or impact or power tool methods as appropriate for the condition of the surface and the requirements of the coating system.

9. Surface Preparation (SSPC-SP16): Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

### **3.9 FERROUS METAL SURFACE PREPARATION (UNGALVANIZED)**

- A. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these requirements and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.
- B. Oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC SP1 - Solvent Cleaning prior to blast cleaning.
- C. Round or chamfer all sharp edges and grind smooth burrs and surface defects and weld splatter prior to blast cleaning.
- D. Surfaces shall be cleaned of dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method prior to painting.
- E. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.
- F. Damaged or defective coating shall be removed by the blast cleaning to meet the clean surface requirements before recoating.
- G. If the required abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC SP2 or SSPC SP3 may be used as per manufacturers recommendations.
- H. Shop-applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC SP1 before the abrasive blast cleaning has been started.
- I. Shop primed equipment shall be solvent-cleaned in the field before finish coats are applied.
- J. Exposed ductile iron pipe shall be given a shop coat of rust-inhibitive primer conforming to these specifications. Abrasive blasting of the asphaltic coating on ductile iron pipe will not be allowed.

### **3.10 FERROUS METAL SURFACE PREPARATION (GALVANIZED)**

- A. Galvanized ferrous metal shall be alkaline cleaned per SSPC SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system, followed by blast cleaning per SSPC SP16.
- B. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

### **3.11 CONCRETE BLOCK MASONRY SURFACE PREPARATION**

- A. Surface preparation shall not begin until at least 30 Days after the masonry has been placed.
- B. Oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC SP1 before abrasive blast cleaning.
- C. Concrete block masonry surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface recommended by manufacturer.
- D. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, rinse surfaces with water and test the pH. The pH shall be between neutral and 8.
- E. Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.
- F. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model BD-2100, or equal.

### **3.12 CAST-IN-PLACE CONCRETE SURFACE PREPARATION**

- A. Concrete surfaces to receive protective coating shall be cast with a Smooth Form Finish in accordance with ACI 301. Surfaces shall not be rubbed, sacked, troweled or otherwise finished in any manner that will obscure or cover the parent concrete surface with materials other than materials as specified in this Section.
- B. All surfaces must be clean, dry and free of oil, grease and other contaminants, prior to preparation in accordance with NACE No. 6/SSPC-SP13. Concrete surfaces must be sound and capable of supporting the corrosion protection lining system.
- C. Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers, existing coatings, and other contaminants and to provide the recommended ICRI-CSP Profile.
- D. Level or grind concrete substrates to produce a uniform and smooth surface, including removal of sharp edges, ridges, form fins, and other concrete protrusions.
- E. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model BD-2100, or equal.

### **3.13 SHOP COATING REQUIREMENTS**

- A. Unless otherwise indicated, items of equipment or parts of equipment which are not submerged in service shall be shop-primed and then finish-coated in the field after installation with the indicated or selected color. The methods, materials, application equipment, and other details of shop painting shall comply with this Section. If the shop

primer requires topcoating within a specific period of time, the equipment shall be finish coated in the shop and then be touched up after installation.

- B. Items of equipment or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have surface preparation and coating performed in the field.
- C. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its Shop Drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the Shop Drawings for the equipment.
- D. For certain small pieces of equipment, the manufacturer may have a standard coating system that is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the Shop Drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.
- E. Shop-painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before being topcoated, or less time if recommended by the coating manufacturer.
- F. CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment Shop Drawings.
- G. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.

### **3.14 APPLICATION**

#### **A. General**

1. Schedule inspection with ENGINEER in advance for cleaned surfaces and all coats prior to each succeeding coat.
2. Apply coatings in accordance with the paint manufacturer's recommendations and these specifications, whichever is more stringent. Allow sufficient time between coats to assure thorough drying of previously applied paint.
3. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same day.
4. Special attention shall be given to materials that will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
5. Finish coats, including touch-up and damage repair coats shall be applied in a manner that will present a uniform texture and color matched appearance.
6. Non-buried steel piping shall be abrasive blast cleaned and primed before installation.
7. Finish coats shall be applied after concrete, masonry, and equipment installation is complete, and the working areas are clean and dust free.

### **3.15 CURING OF COATINGS**

- A. CONTRACTOR shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent, prior to placing the completed coating system into service.
- B. In the case of enclosed areas, forced air ventilation, using heated air, if necessary, may be required until the coatings have fully cured.

### **3.16 SHOP AND FIELD OBSERVATION AND TESTING**

- A. CONTRACTOR shall give ENGINEER a minimum of 3 Days advance notice of the start of any field surface preparation or coating application, and a minimum of 7 Days advance notice of the start of any surface preparation activity in the shop.
- B. Observation by ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.
- C. CONTRACTOR shall furnish inspection devices in good working condition for the detection of holidays and measurement of dry film thicknesses of coatings. Dry-film thickness gauges shall be made available for ENGINEER's use while coating is being done, until final acceptance of such coatings. CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of ENGINEER.
- D. CONTRACTOR shall test for continuity (holiday test) all coated surfaces inside reservoirs, other surfaces that will be submerged in water or other liquids, surfaces that are enclosed in a vapor space in such structures, and surfaces coated with any of the submerged and severe service coating systems. Areas that contain discontinuities shall be marked and repaired or recoated in accordance with the coating manufacturers' printed instructions and then be retested.
  - 1. Coatings with thickness exceeding 20-mils total DFT: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the required coating thickness.
  - 2. Coatings with thickness of 20-mils or less total DFT: Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10- and 20-mils, a nonsudsing type wetting agent, such as Kodak Photo-Flo or equal, shall be added to the water prior to wetting the detector sponge.
- E. On ferrous and non-ferrous the dry film coating thickness shall be measured in accordance with the SSPC PA 2 using a magnetic type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

- F. Evaluation of blast cleaned surface preparation will be based upon comparison of the blasted surfaces with the standard samples available from SSPC and NACE, such as using NACE standards TM-01-70 and TM-01-75.
- G. Visually inspect concrete, nonferrous metal, plastic, drywall, and wood surfaces to ensure proper and complete coverage has been attained.

### **3.17 CLEANUP**

- A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.
- B. Upon completion of the work, remove staging, scaffolding, and containers from the site or destroy in a legal manner.
- C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.
- D. Damages due to overspray on buildings, vehicles, trees, or other surfaces not specified to be painted would be the responsibility of CONTRACTOR.

### **3.18 MANUFACTURER' SERVICES**

- A. Furnish paint manufacturer's representative to visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

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**SECTION 09 98 10**  
**PIPELINE COATINGS AND LININGS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall apply external coating and internal lining on steel pipe, field coating of joints, and field repair of coating damage, complete and in place, in accordance with the specifications.
- B. Steel pipe shall be dielectrically-coated with a tape wrap and coated (over tape) with a mortar rock shield coat as defined here-in. Flanges shall be epoxy coated and field wax tape coated per AWWA C217 and this spec.
- C. Exposed steel pipe will be coated in accordance with Section 09 90 00 – Painting and Finishes, unless noted otherwise.

**1.2 RELATED WORK**

- A. Related Work in other sections includes, but is not limit to:
  - 1. Section 01 33 00 Submittals Procedures
  - 2. Section 09 90 00 Painting and Finishes
  - 3. Section 26 42 00 Galvanic Cathodic Protection System
  - 4. Section 33 12 00 Mechanical Appurtenances
  - 5. Section 33 92 10 Steel Pipe, Specials, and Fittings (AWWA C200, modified)

**1.3 REFERENCES AND STANDARDS**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:
- B. Occupation Safety and Health Act: State of Utah and Federal
- C. AMERICAN WATER WORKS ASSOCIATION (AWWA)
  - 1. AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4-inch and Larger- Shop Applied.
  - 2. AWWA C209 Cold-Applied Tape Coating Systems for the Exterior of Special Sections, Connection, and Fittings for Steel Water Pipelines
  - 3. AWWA C214 Tape Coating Systems for the Exterior of Steel Water Pipelines
  - 4. AWWA C216 Heat-shrinkable Cross-linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
  - 5. AWWA C217 Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

D. NATIONAL ASSOCIATION OF CORROSION ENGINEERS INTERNATIONAL (NACE)

1. NACE RP 274      High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation

E. SOCIETY FOR PROTECTIVE COATINGS (SSPC)

1. SSPC-SP-1      Solvent Cleaning Surface Preparation
2. SSPC-SP-2      Hand Tool Cleaning Surface Preparation
3. SSPC-SP-3      Power Tool Cleaning Surface Preparation
4. SSPC-SP-5      White Metal Abrasive Blast Surface Preparation
5. SSPC-SP-6      Commercial Abrasive Blast Surface Preparation
6. SSPC-SP-10      Near White Metal Abrasive Blast Surface Preparation
7. SSPC-SP-11      Power Tool to Bare Metal

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit catalog cuts and other manufacturer's performance information for products proposed that demonstrate compliance with the Specifications herein described. Provide a copy of approved coating system submittals to the coating applicator. Provide Paint System Data Sheets (PSDS) and/or Material Safety Data Sheets (MSDS) for coating and lining materials.
- C. Quality Control Submittals
  1. Applicator's experience with list of references substantiating compliance.
- D. If the manufacturer of field-applied coating differs from that of the shop-applied primer, furnish written confirmation from both manufacturers that the 2 coating materials are compatible

**1.5 QUALITY ASSURANCE**

- A. All inspection for quality assurance shall ultimately be the responsibility of CONTRACTOR. OWNER retains the right to observe, accept, or reject the work based on the results of CONTRACTOR's inspection or observations by ENGINEER, at OWNER's discretion, in accordance with the specifications.
- B. Coating applicator shall have a minimum of 2 years experience applying the specified coating system and the application supervisor (Certified Applicator) for the coating application personnel shall have a minimum of 5 years practical experience in application of the indicated products.
- C. Coating and/or lining manufacturer technical representative shall be present for a minimum of 3 days to furnish technical assistance and instruction at the start of coating and/or lining operations within the shop and at the Site. During these visits, 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.

- D. Coating and/or lining manufacturer shall furnish 8 hours per month of field or shop coating technical support if requested by ENGINEER.
- E. Technical representative shall provide a written report to ENGINEER for each visit. Report shall include copies of test data collected, description of observations, and recommended corrective actions. Report shall be submitted within 10 working days after the visit. When deemed necessary by ENGINEER, work will not be permitted to proceed until the recommended corrective actions have been implemented. After corrective recommendations have been implemented; the manufacturer representative shall return and certify that the application complies with the manufacturer's coating application recommendations.
- F. 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.
- G. Repair and recoat all runs, overspray, roughness, or any other signs of improper application in accordance with paint manufacturer's instructions and as reviewed by ENGINEER.
- H. CONTRACTOR shall notify OWNER and minimum of 14 days prior to the commencement of any work. CONTRACTOR shall provide OWNER and/or ENGINEER with full access to facilities and application documentation. Observation by OWNER and/or ENGINEER, or the waiver of inspection of any particular portion of the work, shall not be construed to relieve CONTRACTOR of his responsibility to perform the work in accordance with these specifications.

## **1.6 DEFINITIONS**

- A. Manufacturer's Representative: Employee of coating manufacturer who is factory trained and knowledgeable in technical aspects of manufacturer's products and systems. Sales representatives are not acceptable as a technical representative unless written authorization from the coating manufacturer is furnished stating the sales representative has full authority to act on behalf of the coating manufacturer.

## **1.7 ABBREVIATIONS**

- |         |                                       |
|---------|---------------------------------------|
| A. ANSI | American National Standards Institute |
| B. AWWA | American Water Works Association      |
| C. MDFT | Minimum Dry Film Thickness            |
| D. Mil  | Thousandths of an Inch                |
| E. OSHA | Occupation Safety and Health Act      |
| F. SSPC | Society for Protective Coatings       |

## **1.8 SPECIAL WARRANTY REQUIREMENT**

- A. CONTRACTOR and coating applicator shall warrant the work under this Section against defective workmanship and materials for a period of two (2) years commencing on the date of final acceptance of the pipeline.

- B. This warrantee shall be in addition to the prime CONTRACTOR's warrantee that covers repair of all defective work, including linings and coatings.

## **1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Do not apply paint in extreme heat, temperatures below 40 degrees F, nor in dust, smoke-laden atmosphere, damp or humid weather.
- B. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, nor whenever surface temperature is less than 5 degrees F above dew point of ambient air. Strictly adhere to manufacturer's recommendations.

## **PART 2 PRODUCTS**

### **2.1 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 manufacturers, and this Section, whichever is more stringent.
- B. Pipeline coating or lining materials shall be the products of a single manufacturer. Product substitutions during the project will not be considered or permitted.
- C. 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.
- D. Coatings and linings will be stored, handled and applied per the manufacturer's written directions.

### **2.2 EXTERIOR SHOP-APPLIED COATINGS**

- A. General
  - 1. Dielectrically coated steel pipe shall be coated in accordance with AWWA C209 and C214, except where noted otherwise. Buried steel pipe shall be shop-coated with the required coating system and a 1-inch thick cement mortar "rock shield" coating with  $\pm 1/4$ " tolerance, as specified herein.
  - 2. 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.
  - 3. Pipe that is atmospherically exposed shall be shop primed as specified herein and in accordance with Section 09 90 00 – Painting and Finishes.
- B. Polyethylene Tape Wrap
  - 1. Steel pipe shall be coated with the following 80-mil (nominal) tape-coating system applied in accordance with AWWA C214 and this Section
  - 2. **Polyken YGIII** Tape Coating System:
    - a. Primer: **Polyken 1019, 1027, 1029**, or as recommended by the coating manufacturer.

- b. Weld Stripe Tape: **Polyken 931** without backing, 25-mils nominal, 4-inches wide minimum.
  - c. Inner Wrap: **Polyken 989 YGIII**, 20-mils nominal, corrosion protection layer.
  - d. Middle Wrap: **Polyken 955 YGIII**, 30-mils nominal, mechanical protection layer.
  - e. Outer Wrap: **Polyken 956 YGIII**, 30-mils nominal, mechanical protection layer.
- 3. Weld Preparation: Provide weld stripe tape or grind welds at pipe fabricator's option.
- 4. Steel Surface Preparation: SSPC-SP5, White Metal blast, 2.5-mils blast profile, minimum.
- 5. Tape Coating Requirements
  - a. Tape layers shall have adhesive for the full width of the tape. Adhesive shall have the ability to stick to itself and to the proceeding tape layer or pipe.
  - b. Each layer shall be a different color or shade with the outer layer white.
  - c. Outer wrap shall have sufficient ultraviolet (UV) inhibitors to resist above grade exposure for a minimum of 12 months or the proposed storage and construction time, whichever is greater.
  - d. Tape width shall be 12-inches maximum. Wider tape will be conditionally allowed if the coating applicator can demonstrate that proper tensioning can be maintained and mechanical wrinkling prevented throughout the coating application. If at any time during the pipe fabrication, tape quality becomes inconsistent with a wider tape, the OWNER may require the remainder of the pipe to be coated using the maximum indicated tape width.
- C. Submit and use Polyken recommend tape coating system for coating steel specials including primer, inner and outer tapes. Apply per manufacturer recommendations.
- D. Cement Mortar "rock shield" Coat:
  - 1. Apply cement mortar "rock shield" coat over a tape wrap coating system on steel pipe and fittings in accordance with AWWA C205, except as modified herein.
  - 2. Cement: Conform to ASTM C150, Type II or V.
  - 3. Aggregate shall be silica sand or other aggregate that is not subject to leaching. Conform to ASTM C33.
  - 4. Cement mortar mixture shall consist of 1 part cement to not more than 3 parts aggregate.
  - 5. Water for cement mortar: Clean and free from organic matter, strong alkalis, vegetable matter, and other impurities. Use no more than 4-1/2 gallons of water per sack of cement.
  - 6. Cement mortar coating: Nominal 1-inch thick coating with permitted tolerance of  $\pm 1/4$  inch.
- E. Exterior Coating for Exposed Coating or Overcoat
  - 1. All atmospherically exposed or vault piping shall be shop primed with the coating system as specified in Section 09 90 00 – Painting and Finishes.
  - 2. Manufacturer of shop-applied primer shall be coordinated with field application to provide a completed system by a single manufacturer as specified in Section 09 90 00 – Painting and Finishes. OWNER approval of a coating system with two or more coating manufacturers will required written approval from all coating manufacturer's as to compatibility and acceptance under warranty.

## **2.3 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 shall conform to ASTM C150, Type II.
3. Shop applied cement mortar lining shall be uniform in thickness over the full length of the pipe joint.
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.

## **2.4 SPECIALS, FITTINGS, AND CONNECTIONS**

- A. Coating and lining application for special sections, connections, and fittings shall conform to coating system and application requirements in this Section. Internal Mortar lining shall be applied to all specials, fittings and pipes with outlets. All specials, fittings and pipes with outlets shall also be shop-coated with a cement mortar "rock shield" coat.
- B. Specials, fittings, and pipes with outlets 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 that require special fabrication that prevents mechanical production application of the indicated coating system from end to end of pipe joint as defined herein.
- C. In addition to the items listed above as specials, the following items shall also be considered as specials: Pipe joints with pass through holes.
- D. Hand-applied tape coatings will not be permitted on any specials, fittings, connections, pipes with outlets and elbow fittings.

## **2.5 EXTERIOR FIELD COATING FOR FLANGED JOINTS**

### **A. Field joint coating materials (for flanged joints) shall be as follows.**

1. Wax Tape Coating
  - a. Wax tape coatings shall be limited to field application on joints, fittings, or irregular shapes or complex configurations that are not suited for the use of heat shrink or hand-applied tape wrap coating systems.
  - b. Apply coating in accordance with AWWA C217, except as modified herein.
  - c. Provide filler material to fill and smooth irregular surfaces, such that no tenting or voids remain under the applied wax tape.
  - d. Protect coating from damage and provide special sand backfill protect wax coating from damage.
  - e. Coating System

- 1) Surface Preparation: SP3 Power Tool or 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.
- f. Wax tape coating system shall be as manufactured by, or approved equal:
  - 1) **Petrolatum Tapes by Denso North American**
  - 2) **Wax-Tape by Trenton**

## 2.6 INTERIOR FIELD JOINT LINING (NOT USED)

- A. Do not weld or line steel pipe in the field.

## 2.7 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. Major repairs on tape wrapped coatings shall be repaired using heat shrink sleeves as indicated for field joint coating in accordance with AWWA C216, except as modified herein.
3. Minor repairs on tape wrapped pipe shall be with heat applied patches.

### 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 minimum, 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: **AquaSleeve by Canusa-CPS, Covalence by Berry CPG**, or approved equal.
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.
  - c. Manufacturers: **CRP patch by Canusa, PERP patch Berry CPG**, or approved equal.

### C. Exposed Pipe Coating System

1. Touch-up repair all damage to primer and/or intermediate coats with the specified coating system prior to final coating of the pipeline in accordance with Section 09 90 00 – Painting and Finishes.

## **PART 3 EXECUTION**

### **3.1 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 or 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 these 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. When it is expected that surface temperatures would drop below 5 degrees above dew point within 4 hours after application of coating.
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 indicated and in accordance with the manufacturer's coating application recommendations.
6. Work activities may be restricted until adequate temperature and humidity controls are in place and functioning within the environmental limits given.
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, if the temperature of the pipe is less than 45 deg F, preheat the pipe to a temperature of 50 deg F or 5 degrees above dew point, whichever is greater.
2. When temperatures are above or below the coating manufacturer's recommended application temperatures, CONTRACTOR shall provide temperature controls as necessary to permit the work to proceed 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 propane fired heaters that do not increase humidity levels within the working area. Heaters shall be sized for the area to be heated.

#### **C. Dehumidification**

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 shall use personnel properly trained in the operation and maintenance of the dehumidification equipment or provided adequate training by the dehumidification equipment supplier.
6. Daily maintenance requirements of the equipment shall be documented in writing and posted near the equipment for review if required by ENGINEER.
7. Re-blasting 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 CONTRACTOR.

### **3.2 OBSERVATION OF WORK**

- A. CONTRACTOR shall give ENGINEER a minimum of 14 days advance notice of the start of any coating work to allow scheduling for shop or field observation. Notify ENGINEER a minimum 3 days in advance of actual start of surface preparation and coating application Work.
  1. Provisions shall be made to allow ENGINEER full access to facilities and appropriate documentation regarding coating application.
  2. Observation by ENGINEER or the waiver of observation of any particular portion of the coating work shall not be construed to relieve CONTRACTOR of responsibility to perform the coating in accordance with these Specifications.
  3. Materials shall be subject to observation for suitability as ENGINEER may determine, prior to or during incorporation into the work.

### **3.3 SURFACE PREPARATION**

#### **A. General**

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications 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. 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. Application
  - a. Spray applied coating systems do not require weld grinding.
  - b. Grind welds on tape wrap coated pipe or apply weld stripe tape over the weld, at the pipe fabricator's option, unless otherwise indicated.
2. Weld Grinding: Under the weld grinding option, welds taller than 3/32-inch above pipe surface shall be ground to a tolerance of +3/32-inch to zero-inches above the pipe surface as measured on the highest side of the weld.
3. Weld Stripe Tape
  - a. Weld stripe tape shall be applied to primed metal.
  - b. Tape shall either have no polyethylene backing or be double sided adhesive tape to permit adhesion of the inner corrosion protection layer to the weld stripe tape.
  - c. Apply tape with a pressure roller to fully conform the tape to the weld surface.
  - d. Adhesion of the weld stripe tape shall be the same as for the coating system.

## C. Steel Surface Preparation

1. Surface preparation of steel pipe shall be in accordance with SSPC surface preparation standards utilizing the degree of cleanliness appropriate to the coating system to be applied.
2. Grit and/or shot abrasive mixture and gradation shall be as required to achieve the degree of cleanliness and coating adhesion required.
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. Preparation of the steel pipe shall have a sharp angular surface profile of the minimum depth indicated.
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 required metal surface cleanliness prior to rust back or flash rusting. Determination of the equivalent surface cleanliness shall be at ENGINEER'S sole discretion.

## 3.4 SHOP-APPLIED COATING SYSTEMS

### A. Tape Wrap Coating

1. Applicator shall use a monitoring system approved by the tape manufacturer that constantly records pipe and tape conditions during coating application. Recorded monitoring parameters shall include, but not be limited to; pipe temperature, line speed, primer and tape roll body temperature, and tape tension.
  - a. Pipe surface temperature shall be between 45 and 120 degrees and 5 degrees above dew point, whichever is greater.
  - b. Tape roll temperature shall be in accordance with the manufacturer's recommendations, but shall not be less than 55 degrees for the inner wrap and 65 degrees for the outer wraps.
2. Apply a uniform coat of primer as recommended by the manufacturer without skips, runs, or sags. Allow to properly dry prior to applying the tape as required by the tape manufacturer and as necessary to achieve maximum tape adhesion. Rug type application will not be allowed.

3. If welds are not ground flush, apply a weld stripe tape to longitudinal or spiral pipe welds prior to application of the inner wrap.
  4. Tape layers shall be applied continuously with the use of hydro-tension tape stands. Tension shall be maintained between the manufacturer's minimum and maximum tension recommendations or as required to achieve approximately 2.0 percent reduction in tape width.
    - a. Inner tape wrap shall adhere tightly to the pipe surface. Coating shall be 100 percent adhering to the metal surface and shall not have any visible damage, wrinkles, voids, disbondment, contamination, or holidays.
  5. Tape coating adhesion testing shall be performed on the pipe per this Section.
  6. Holidays testing shall be conducted on the inner layer tape prior to proceeding with subsequent tape layers. Holidays shall be primed and patched using coating repair procedures herein.
  7. Perform coating and lining repairs per this Section.
- B. For steel pipe specials to be buried. Shop apply Polyken recommend tape coating system for coating steel specials including primer, inner and outer tapes per manufacturer recommendations.
- C. Cement Mortar and Overcoat Coatings
1. Steel pipe shall have a cement mortar coating applied in accordance with AWWA C205, except as modified herein.
  2. Dielectrically coated steel pipe, when specifically required, shall have a cement overcoat (rock shield) applied over the dielectric pipe coating in accordance with AWWA C205, except as modified herein.
  3. Cement Mortar Coating:
    - a. Reinforcement:
      - 1) For pipe and specials smaller than 48-inches in diameter, reinforce coating with spirally-wound No. 12 gage steel wire spaced at 1-inch centers or with No. 4 gage steel wire at 1/2-inch centers positioned approximately in center of mortar coating.
      - 2) For pipe and specials 48-inches in diameter and larger, reinforce coating with 2 layers of spirally-wound No. 12 gage steel wire spaced at 1-inch centers or with No. 4 gage steel wire at 1/2-inch centers positioned approximately in center of mortar coating.
      - 3) Lap ends of reinforcement strips 4-inches and tie or loop free ends to assure continuity of reinforcement.
      - 4) All steel wire reinforcement placed in the mortar coating shall be electrically isolated from the pipe. Electric isolation will be tested using high voltage spark test by the manufacturer prior to shipment to the project site. Provide certification that electrical isolation of reinforcement wire from steel pipe.
    - b. Coating Defects:
      - 1) Coating defects shall be repaired as specified in AWWA C205, except as modified herein.
  4. Cement Mortar Overcoat
    - a. Cement mortar overcoat dielectrically coated steel pipe as specified in AWWA C205, except mortar coating shall be applied over exterior pipe coating.

- b. Mortar coating shall be held back 3-inches, minimum, behind dielectric coating system cut back at joints. Holdback shall be increased with extruded polyethylene coating as required to maintain the minimum overlap specified for joint coating application, where specifically required to be cement mortar overcoated.
- c. Coating Defects:
  - 1) Cracking in the mortar "rock shield" coating less than 1/8-inch in width will be acceptable.
  - 2) Disbondment of cement coating over a dielectric coating system should be anticipated and will not be grounds for repair or rejection of the pipe.
  - 3) Losses of cement mortar coating due to impact, movement, or shipping damage shall be repaired in accordance with AWWA C205.

### 3.5 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 these requirements.
- C. Holdbacks shall be as required for proper jointing of pipe, considering joint welding requirements, and be as follows:

Tape wrap coating	
Push-on joint, spigot	4-inches, minimum
Push-on, bell	Flush with bell end
Welded, spigot	3-inches, minimum
Welded, Bell	4-inches, minimum
Epoxy coating	
Push-on joint, spigot	Flush with spigot end
Push-on, bell	Flush with bell end
Welded, spigot	3-inches, minimum
Welded, Bell	4-inches, minimum

#### D. Holdback Corrosion Protection

- 1. Holding primer for corrosion protection of cutbacks or holdbacks shall be compatible with the joint coating system, shall prevent corrosion of prepared pipe ends for duration of storage and construction, and be recommended for buried exposures.

2. Primer shall be compatible with welding operations and shall not result in running or melting of the coating during welding operations.
3. Application and thickness of holding primer shall be in accordance with the primer manufacturer's recommendations, but shall not impair the clearances required for proper joint installation.
4. Any corroding holdback areas shall be abrasively blasted to SP10 or power tool cleaned to bare metal in accordance with SP11 prior to applying joint coating.

### 3.6 PIPE LINING APPLICATION

#### A. Shop-Applied Cement Mortar Lining

1. Place mortar lining used in steel piping and steel plate specials in pipe to thickness below.

Pipe Diameter, Inches	Lining Thickness, Inches	Tolerances, Inches
4 through 10	3/8	-1/16, +1/8
11 through 24	5/16	-1/16, +1/8
24 through 36	3/8	-1/16, +1/8
Greater than 36	1/2	-1/16, +3/16

2. 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.
  - a. Steel plate specials larger than 16-inches in diameter shall have lining reinforced with 2-inch by 4-inch No. 13-gauge welded steel wire mesh.
  - b. Brace and support pipe during lining application to minimize pipe distortion or vibration. Bracing and supports shall not damage the pipe, coating, or lining.
  - c. Tightly close ends of pipe and fittings with plastic sheet caps within 30 minutes of lining application. Plastic end caps shall be of sufficient thickness and strength to resist shipping, handling, and storage stresses.
  - d. 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.
  - e. Other requirements of mortar lining materials and processes are in AWWA C205.

### 3.7 FIELD WELDED JOINTS - LININGS AND COATINGS

- A. Field welded joints are not allowed for steel pipe on this project, so there are no linings and coatings for such.

### 3.8 FIELD COATING FLANGED JOINTS

- A. Field coat flanged joints with wax tape coat per AWWA C217 and this spec.

### 3.9 REPAIR OF COATING AND LININGS

#### A. General

1. 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 defects allowable shall be as indicated for the coating system.

#### B. Tape Wrap Coating Repairs

##### 1. General

- a. No more than 5 repairs per joint of pipe will be permitted with tape wrap coating, excluding adhesion test damage. The coating on any pipe with more than 5 coating repairs or with more than 2 areas of coating damage greater than 5 square feet will be rejected.
- b. Pipes exceeding the maximum number or size of coating defects shall be stripped, reblasted, and recoated at the CONTRACTOR's expense.
- c. 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 CONTRACTOR's expense.
- d. The number of layers and total thickness of the tape repair coating shall be the same as the shop-applied coating; unless heat applied coating materials are used.
- e. Wipe the area to be repaired with solvent for a minimum distance of 4-inches outside the damaged area.

##### 2. Defect Size

- a. Minor repairs - repairs that are less than 6-inches in the greatest dimension, measured after cutout of damaged tape layers. Damage to the inner tape layer will be considered minor only if repairs are made using heat-applied patch materials.
- b. Major repairs - repairs that exceed 6-inches in the greatest dimension or where damage to the inner tape layer has occurred.

##### 3. Minor Repairs

- a. Complete minor repairs using a heat-applied coating patch material.
- b. Cut patch material to overlap onto the undamaged coating a minimum of 2-inches on all sides with one-inch radius on each corner of the patch.
- c. Carefully remove damaged layers by cutting the coating with a sharp knife without cutting or damaging the inner wrap.
- d. Cut middle and outer layers in stepped fashion to expose one-inch or more of the underlying tape layer for the circumference of the repair.

##### 4. Major Repairs

- a. Coating repairs shall be with heat shrink sleeves as indicated for joints.
- b. Carefully remove damaged layers by cutting the coating with a sharp knife without cutting or damaging the inner wrap.
- c. Holiday test the inner wrap and if a holiday is detected cut outer layers back to fully exposed the holidays and retest for holidays.
- d. Cut middle and outer layers in stepped fashion to expose one-inch or more of the underlying tape layer for the circumference of the repair.

- e. Width of sleeve shall be the width of the damaged area plus 4-inch overlap. Multiple sleeves may be used for larger repairs, but must be overlapped a minimum of 2-inches.

#### C. Cement Mortar Coating

1. Cement mortar coating that is cracked or disbonded shall be repaired in accordance with AWWA C205, except for mortar overcoat on tape wrapped steel.
2. Disbonded mortar coating shall be removed and patched.
3. Mortar coating with disbondment greater than 25 percent of the pipe surface shall be rejected and recoated.
4. Cracks in mortar coating shall be repaired in accordance with AWWA C205.

### 3.10 INSPECTION AND TESTING

#### A. Inspection

1. Applicator shall inspect and test the coating system in accordance with referenced standards and these specifications, 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 specification.
3. CONTRACTOR will conduct random independent inspections and tests for the final acceptance or rejection of pipe coating or lining.

#### B. Adhesion Testing, General

1. 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 CONTRACTOR.
2. A minimum of 2 pipes will be tested for adhesion from each lot of pipe coated up to 4,000 square feet of pipe. An additional adhesion test will be conducted on every increment up to 3,000 square feet of pipe coated in excess of the first 4,000 square feet of pipe. (i.e. if one workday of production is 8,000 square feet of pipe, 4 adhesion tests will be conducted on the pipe lot.
3. 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.
4. The pipe coating applicator shall repair coating damage from adhesion testing.
5. 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 criterion and the test was requested by the pipe fabricator.
6. Pipe will be randomly selected for adhesion testing.
7. If any pipe tested fails the adhesion test, all pipes within the lot will be rejected. Each pipe within the rejected pipe lot will then be individually tested for adhesion and accepted or rejected on a pipe-by-pipe basis.
8. Rejected pipe shall have the coating fully removed from the pipe and the pipe abrasive blasted and recoated.

#### C. Adhesion Testing, Tape Wrap

1. Inner tape coating shall have an adhesion of 20 pounds per inch width on steel pipe or 15 pounds per inch width on ductile iron pipe, minimum, when tape is pulled in a continuous manner at an angle of 180 degrees to the pipe surface.
2. Adhesion tests shall be conducted at temperatures above 60 degrees F and less than 80 degrees F.
3. Pulling tension shall be continuous, without stopping, and monitored throughout the length of the pull, which shall be not less than 12-inches in length.
4. The pull tension shall be recorded for each inch of pull. The 2 highest and 2 lowest readings shall be discarded and the remaining values averaged. Pull speed shall be not less than 5 seconds per inch nor greater than 10 seconds per inch. If elongation of the tape backing occurs, pull speeds may be exceed 10 seconds per inch provided the minimum adhesion rating can still be achieved.
5. Failure shall be by cohesive failure of the adhesive only. Delamination failure, defined as separation of the adhesive from the backing material, will result in rejection of the tape lot. Intermittent skip failures will be counted as zero pounds of adhesion and included in the calculations for average coating adhesion. Adhesive failure, defined as separation of the adhesive from the metal substrate, will be rejected.
6. Pipe that fails the test by delamination will be retested on 2 other pipes within the same lot of coated pipe. Failure of any 2 pipes within the lot will result in rejection of all pipes coated with the rejected tape lot.

**D. Holiday Testing**

1. Holiday test the inner layer of tape wrap coatings after application and prior to the subsequent tape layer in accordance with AWWA C214 and NACE Standard RP 0274.
2. Coating thickness used for holiday testing shall be the minimum coating thickness.
3. Dry Film Thickness Testing
  - a. Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off or eddy current equipment.
  - b. 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 specification.

**3.11 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, and transportation, every precaution shall be taken to protect and prevent damage to pipe, lining, and coating. Forklift equipment shall have load-bearing surfaces padded with suitable material. Lift pipe with web slings a minimum of 12-inches wide and of a type that will not damage the coating. Metal chains, cables, 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. 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, sand bags, 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 contact points.
- F. Pipe shall be inspected by CONTRACTOR at the Site for damage. Any damage to the pipe, lining, or coating shall be repaired if a satisfactory repair can be made; otherwise, the damaged section shall be replaced at the sole expense of CONTRACTOR.
- G. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the finished coating. Workers shall not be permitted to walk on the coating except when absolutely necessary. When required, 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 length of above grade exposure or covered to prevent UV degradation of outer wrap. Amount of UV stabilizers required shall depend on the project location, laying schedule, anticipated length of exposure, and type of outer wrap. Coating 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 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 to remain 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 manufacturer shall 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. Adequate strutting shall be provided by pipe manufacturer, so that after completion of backfilling, pipe deflection or elongation shall not exceed one percent of the nominal inside diameter of cement-mortar-lined pipe.
  - 2. The minimum bracing shall consist of crossed struts (horizontal and vertical). The maximum spacing along the pipe shall be near each end and at the one-third points for each 48-foot section of pipe, with a minimum of 4 sets of struts per 48-foot section of pipe. Random lengths of pipe shall have an equivalent number of sets of struts, with a minimum of one set of struts in a 10-foot section of pipe

3. 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. Damage shall be repaired to the satisfaction of ENGINEER.

- END OF SECTION –

**SECTION 10 44 00**  
**FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. The CONTRACTOR shall provide fire protection equipment and appurtenant work, complete and in place, according to the Contract Documents.
- B. If more than one fire extinguisher or other fire protection equipment is required, provide products from a single manufacturer.

**1.2 RELATED WORK**

- A. Related work in other Sections includes but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM E 814 Standard Test Method for Fire Tests of Penetration Firestop Systems
- C. NATIONAL FIRE PROTECTION ASSOCIATION PUBLICATIONS (NFPA)
  - 1. NFPA No. 10 Standard for Portable Fire Extinguishers
- D. INTERNATIONAL FIRE CODE (IFC)

**1.4 SUBMITTALS**

- A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures
- B. Submit manufacturer's literature, installation instructions, and fire protection equipment details.

**1.5 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for fire protection equipment. Full compensation for the equipment shall be considered as included in the contract unit or lump sum bid prices for the various items of the Contract to which it relates.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Fire protection equipment shall comply with the IFC, NFPA Pamphlet No. 10, and the manufacturer's recommendations.

### **2.2 MATERIALS**

- A. Fire Extinguisher Designated FE-1: FE-1 fire extinguishers shall be 10 pound minimum capacity, A.B.C. dry-chemical type, with minimum UL rating of 4A:80BC.
- B. Mounting brackets shall be specially designed for fire extinguisher.
- C. Other materials not specifically shown on the drawings or listed in the specifications but required for a complete and proper installation shall be as selected by the CONTRACTOR, subject to approval by the ENGINEER.
- D. Fire protection equipment shall be manufactured by **Larsen's Manufacturing, Amerex Corporation, Potter-Roemer**, or approved equal.

## **PART 3 EXECUTION**

### **3.1 DELIVERY AND STORAGE**

- A. Fire protection equipment shall be delivered to the site in unbroken packages or containers bearing the manufacturer's label with product description and rating.
- B. Products shall be carefully stored in an area that is protected from deleterious elements as recommended by the manufacturer. Storage shall be in a manner that will prevent damage to the material and finish of the equipment.

### **3.2 INSTALLATION**

- A. All equipment shall be wall mounted, where shown on the plans, and installed as per NFPA Pamphlet No. 10 and the manufacturer recommendations unless otherwise directed by the Fire Marshall. Coordinate final location and mounting heights with the fire Marshall prior to installation.
- B. Fire extinguishers shall be provided with and installed on brackets or brackets within cabinets. The CONTRACTOR shall provide blocking and other reinforcing in walls to support the fire extinguishers.

- END OF SECTION -

**SECTION 22 10 10**  
**PLUMBING PIPING AND SPECIALTIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. CONTRACTOR shall furnish and install plumbing piping and specialties, complete and operable, as indicated on the Contract Drawings and in accordance with the Contract Documents.
- B. Plumbing piping and specialties includes piping, pipe hangers, sleeves, supports, brackets, valves, drains, cleanouts, hose bibbs, concealed wall hydrants, and related items.

**1.2 RELATED WORK**

- A. Related work specified in other Sections includes, but is not limited to:

- 1. Section 01 33 00 Submittal Procedures
- 2. Section 05 45 00 Mechanical Metal Supports
- 3. Section 09 90 00 Painting and Finishes
- 4. Section 33 05 03 Copper Pipe
- 5. Section 33 05 26 Utility Identification
- 6. Section 33 12 00 Mechanical Appurtenances
- 7. Section 33 13 00 Pipeline Testing and Disinfection
- 8. Section 40 05 13.19 Stainless Steel Process Piping

**1.3 MEASUREMENT AND PAYMENT**

- A. Plumbing piping shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

**1.4 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publication is referred to in the text by basic designation only.
- B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
  - 1. B31.1 Power Piping
- C. AMERICAN STANDARDS FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 74 Standard Specification for Cast Iron Soil Pipe and Fittings
  - 2. ASTM B 43 Standards for Seamless Red Brass Pipe
- D. CAST IRON SOIL PIPE INSTITUTE (CISPI)
  - 1. CISPI 301 Standard Specification for Hub-less Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

E. INTERNATIONAL MECHANICAL CODE (IMC)

F. INTERNATIONAL PLUMBING CODE (IPC)

G. FACTORY MUTUAL INSURANCE COMPANY (FM GLOBAL)

1. FM 1680 Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/Commercial and Residential

## **1.5 PIPING SYSTEM LAYOUTS**

- A. Piping system drawings are diagrammatic and are intended to show approximate location of equipment and piping. Verify dimensions, whether in figures or scaled, in the field. CONTRACTOR is responsible for the installation of complete and workable systems whether completely detailed on the plans or not.
- B. Ascertain locations of apparatus, fixtures, equipment, and piping in the field, and layout work accordingly. ENGINEER reserves the right to make minor changes in location of piping and equipment up to the time of installation without additional cost to OWNER.

## **1.6 SUBMITTALS**

- A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit general arrangement drawings of system components.
- C. Submit product catalog cut sheets and other manufacturer information.

## **1.7 REQUIREMENTS OF REGULATORY AGENCIES**

- A. Install work per applicable provisions of codes, rules, regulations, statutes, and ordinances of authorities having jurisdiction.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Plumbing piping and specialties shall be as recommended by the manufacturer for the intended use.
- B. Any pipe, plumbing fitting or fixture, solder, or flux used in the installation or repair of any potable water system shall be “lead free” except where necessary for the repair of leaded joints of cast iron pipes.

### **2.2 PIPING AND FITTINGS**

- A. Cast iron sanitary, storm, vent pipe and fittings shall be manufactured in accordance with ASTM A 74.

- B. Hub-less cast iron soil pipe and fittings with **Camp-All** type pipe couplings, or approved equal, shall be used for above ground sanitary, storm, and vent piping where approved for use by local authorities.
- C. Hub-less cast iron soil pipe and fittings shall meet CISPI Standard 301.
- D. Pipe couplings shall have high-torque capacity and shall meet FM Standard 1680.
- E. Copper tubing and fittings for potable water shall be in accordance with Section 33 05 03 – Copper Pipe.
- F. Brass piping shall match iron pipe size standards and meet ASTM B 43 Standards for Seamless Red Brass Pipe.
- G. Stainless Steel Pipe shall be Type 304 Stainless Steel, unless otherwise specified, and shall be in accordance with Section 40 05 13.19 – Stainless Steel Process Pipe.

## 2.3 PIPE HANGERS AND SUPPORTS

- A. Pipe hangers and supports shall meet the requirements of IMC Section 305 Pipe Support, Section 05 45 00 – Mechanical Metal Supports, and the following. If there is a discrepancy in the requirements of these documents the more stringent requirement shall apply.
- B. Properly support, suspend, or anchor all piping and fittings to prevent sagging, over stressing, or longitudinal movement of piping, and to prevent thrust or loads on or against other equipment.
- C. Support horizontal piping on adjustable split steel ring or clevis hangers. The following schedule shows minimum spacing.
  - 1. Steel, Brass and Copper:
 

a. 1-1/4" and smaller	6'-0" on center
b. 1-1/2" thru 3"	8'-0" on center
c. 4" and larger	12'-0" on center
  - 2. PVC, CPVC, AND ABS:
 

a. 1" and smaller	4'-0" on center
b. 1-1/4" thru 2"	5'-0" on center
c. 2-1/2" thru 4"	6'-0" on center
d. 5" and larger	8'-0" on center
- D. Support insulated piping with pipe saddles and hangers that fit on outside of insulation. Do not compress or damage pipe insulation with hangers or supports.
- E. Provide all rigid hangers with a means of vertical adjustment after erection.
- F. Use copper or copper plated hangers for supporting uninsulated copper pipe.
- G. All vertical and horizontal piping supports shall be fiberglass **EnduroStrut by Enduro Systems, Inc.**, or approved equal.
- H. Perforated strap hangers or wire supports will not be permitted.

## 2.4 INSERTS

- A. Furnish and set inserts in concrete forms; provide reinforcing rods for pipe sizes over 3 inches or equivalent.
- B. Furnish concrete inserts as follows: Black, malleable iron, universal type for threaded connections with lateral adjustment. Inserts shall be galvanized unless noted otherwise on the Drawings.

## 2.5 INSULATION

- A. Hot water piping, valves, fittings, and exposed horizontal sanitary, storm, and vent piping shall be provided with one-inch thick insulation.
- B. Covering valves, flanges, fittings, and ends of insulation with pre-molded high- and low-temperature PVC fitting cover, end cap, or similar pre-formed unit. The pre-formed unit covers shall be sized to receive the same thickness insulation as used in adjacent piping.
- C. Exposed supply and drain piping for lavatories shall be insulated under the wash basins in order to prevent burns and abrasions to handicapped persons. Removeable insulated covers shall be **Handy-Shield Type by Plumberex Specialty Products**, or approved equal.

## 2.6 SHIELDS

- A. Provide shields to protect insulation in all areas.
- B. Provide approved galvanized form shields to isolate pipe in contact with hangers and supports.
- C. Furnish low compressive insulation protector shields. Size the shields per the manufacturer's recommendations.

## 2.7 SLEEVES

- A. Where pipes pass through floors, footings, foundations, walls, or ceilings, furnish and install pipe sleeves. Sleeves for concealed piping shall be of Schedule 40 galvanized steel pipe one size larger than the pipe passing through. For exposed piping Schedule 40 black steel pipe installed so as to be completely covered by escutcheons. Extend sleeves through floors 1/2 inch above finish floor.

## 2.8 ESCUTCHEONS

- A. Fit pipe passing through walls, floors, or ceilings with escutcheons with set screws.
- B. Use prime painted escutcheons where surface is to receive a paint finish; otherwise, use escutcheons that are nickel or chromium plated.
- C. Where piping is insulated, use escutcheon outside the insulation.



## 2.9 JOINTS

- A. For screwed pipe make ends with sharp, clean tapered threads using Teflon tape on the male thread only. Do not use mill cut threads. Ream cut pipe to full inside diameter.
- B. Welding may be done by either the arc or acetylene process conforming to the requirements for the ASME B31.1.
- C. For solder joints use fittings specifically made for soldering. Clean all burrs and roughen pipe to clean; solder complete around joint.
- D. For grooved pipe jointing systems use mechanical pipe couplings and fittings.
- E. For no-hub cast iron soil pipe use double screw joint neoprene coupler.

## 2.10 UNIONS

- A. Furnish and install unions for each valve or piece of equipment to permit easy installation and removal of equipment.

## 2.11 VALVES

- A. Water shutoff valves shall be the gate or ball type as designated on the drawings, except on fixture supply piping where globe style valves shall be used.
- B. Hose Bibs shall be provided where indicated on the Drawings. The hose nipple shall be a female iron pipe thread inlet with hose thread outlet. Hose bibs shall be 3/4-inch size unless noted otherwise on the Drawings.
- C. Gate and ball valves shall be in accordance with Section 33 12 00 – Mechanical Appurtenances.

## 2.12 TRENCH DRAIN IN CONCRETE FLOOR

- A. Floor trench drains in concrete floors shall be 4-inch internal width, invert channel of polymer concrete sloped at 0.5% with slotted stainless steel cover.
- B. Trench pieces shall be numbered for proper installation. Provide cleanout catch basin at 90 degree bend into drain pipe.
- C. Floor trench drain shall be **ACO KS100 w/ Type 450 SS grate**, or approved equal.

## 2.13 FLOOR DRAINS IN CONCRETE FLOORS

- A. Floor drains in concrete floors shall be constructed of cast iron of the size indicated on the Drawings and provided with sediment buckets.
- B. Each floor drain located on an upper floor shall have a clamping collar with 4 pound sheet lead flashing 12 inches minimum all around. Where flashing does not comply with local code use epoxy waterproofing membrane.
- C. Floor drains shall be **Z520-Y by Zurn Industries, 32100-AE-81 by Josam Company, Figure 2350 by Jay R Smith Mfg. Co.**, or approved equal.

## 2.14 FLOOR CLEANOUTS

- A. Cleanouts in concrete floors shall be heavy plugs with tapered shoulders against heavy brass plugs.
- B. Cleanout shall have a minimum diameter of 3-inches.
- C. Floor cleanouts shall be fabricated from cast iron with gas and watertight ABS tapered thread plug.
- D. Floor cleanout shall be **Z1400 by Zurn Industries, 55000 Series by Josam Company, 4237 Series by Jay R Smith Mfg. Co.**, or approved equal.

## 2.1 NON-FREEZE CONCEALED WALL HYDRANTS

- A. Non-freeze wall hydrants shall be concealed non-freeze key operated wall hydrant with nickel brass or stainless-steel box and door, chrome plated hydrant face, integral vacuum breaker, 3/4-inch hose connection, all bronze head, seat casting and internal working parts, bronze wall casing, and loose key. Non-freeze wall hydrants shall have a maximum operating pressure 125 psi. Manufacturer shall be **Watts HY-725, Woodward B65, Zurn Z1320-EZ, Jay R Smith 5509QT**, or approved equal.

## 2.2 HOSE BIBBS

- A. Hose bibbs shall be supplied with separate tamper proof vacuum breaker to be attached to the hose bibb after hose bibb installation. Hose bibbs shall be 3/4-inch cast brass with cast iron handwheel and adjustable packing nut. Hose bibbs manufacturer shall be **Watts SC8 Series, American Valve M74, Jay R Smith 5670-H**, or approved equal.

# PART 3 EXECUTION

## 3.1 PREPARATION

- A. Prior to installation of piping, verify that it will not interfere with clearances required for the erection and finish of structural members, architectural members, electrical, sprinkler, or mechanical items.
- B. Hang or support piping materials from roof support system whenever possible.
- C. Do not cut any structural members for installation of piping.

## 3.2 INSERTS

- A. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
- B. Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 3 inches in diameter.
- C. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide rod with recessed squared steel plate and nut above slab.

### **3.3 SLEEVES**

- A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- B. Extend sleeves through potentially wet floors 1 inch above finished floor level. Caulk sleeves full depth and provide floor plate.
- C. Where piping passes through floor, ceiling, or wall, close-off space between pipe and construction with noncombustible insulation. Provide tight-fitting metal caps on both sides and caulk.

### **3.4 PIPE HANGERS AND SUPPORTS**

- A. Support all piping and make adequate provisions for expansion, contraction, slope and anchorage.
- B. The use of pipe hooks, chains, or perforated metal for pipe support will not be permitted.
- C. Suspend all piping in the building as indicated.
- D. Install hangers to provide minimum 1/2-inch clear space between finished covering and adjacent work.
- E. Place a hanger within 1 foot of each horizontal elbow.
- F. Use hangers which are vertically adjustable 1-1/2 inch minimum after piping is erected.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Where practical, support riser piping independently of connected horizontal piping.

### **3.5 PIPING INSTALLATION**

- A. Cut piping accurately for fabrication to measurements established at the construction site and work into place without springing or forcing.
- B. Remove burrs and cutting slag from pipe by reaming or other approved cleaning methods.
- C. Make changes in direction with proper fittings.
- D. Arrange piping so as not to interfere with the removal of other equipment, ducts, or devices. Do not block doors, windows, or access openings. Provide unions in the piping at connections to all equipment. Unions must be accessible.
- E. Cap or plug open ends of pipes and equipment with PVC caps or expanding neoprene plugs to keep dirt and other foreign materials out of the system. Plugs of rags, wool, cotton, waste, or similar materials are not acceptable.
- F. Install all piping systems so they can easily be drained. Provide anti-siphon hose bibbs at low points on water lines.

- G. Slope all soil and waste lines within the building at 1/4 inch per foot fall in the direction of flow unless indicated otherwise.

### **3.6 PRIMING AND COATING**

- A. Prime coat exposed steel hangers and supports and hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces in accordance with Section 09 90 00 – Painting and Finishes.

### **3.7 PIPE LABELING**

- A. Exposed pipe shall be labeled in accordance with Utah State Regulation R309-525-8, Section 33 05 26 – Utility Identification, and the IPC.
  - 1. Labeling shall include direction arrows for flow.

### **3.8 DISINFECTION AND TESTING**

- A. CONTRACTOR shall perform such tests as are required by local ordinances and codes in the presence of the local governing authority inspector to show that piping is tight, leak free, and otherwise satisfactory, and shall perform such tests as ENGINEER may direct to ensure that fixtures and equipment operate properly.
- B. Disinfect potable water piping in accordance with Section 33 13 00 - Pipeline Testing and Disinfection.
- C. Test all potable water piping.
- D. Repair defects which develop under tests promptly and repeat tests. No caulking or screwed joints, cracks, or holes will be permitted. Replace pipe or fitting or both with new material when repairing leaks in screwed joints.
- E. Repair leaks in copper tubing by melting out joint, thoroughly cleaning both tubing and fitting, and resoldering.

- END OF SECTION -

**SECTION 26 05 00**  
**ELECTRICAL GENERAL REQUIREMENTS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. It is the intent of this part of the Contract Documents to cover all Work and materials necessary for erecting complete, ready for continuous use, a tested and working electrical system, substantially as indicated on the Plans and as hereinafter specified.

**1.2 GENERAL PROVISIONS**

- A. Minimum sizes of equipment, electric devices, etc., are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the Work.
- B. All Work indicated on the Plans is approximately to scale, but actual dimensions and detailed drawings should be followed as closely as field conditions permit. Field verification of scale dimensions on Plans is directed since actual locations, distances, levels, etc. will be governed by field conditions.
- C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of ENGINEER for a decision.
- D. The alignment of equipment and conduit shall be varied due to architectural changes, or to avoid work of other trades, without extra expense to OWNER.
- E. CONTRACTOR shall furnish and install all parts and pieces necessary to the installation of equipment in accordance with the best practice of the trade and in conformance with the requirements of these Contract Documents.
- F. All items not specifically mentioned in these Contract Documents or noted on the Plans or accepted Shop Drawings, but which are obviously necessary to make a complete working installation, shall be deemed to be included herein.
- G. CONTRACTOR shall lay out and install electrical work prior to placing floors and walls. He shall furnish and install all sleeves and openings through floors and walls required for passage of all conduits. Sleeves shall be rigidly supported and suitably packed or sealed to prevent ingress of wet concrete.
- H. CONTRACTOR shall furnish and install all inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, etc. are improperly placed or installed, CONTRACTOR shall do all necessary work, at his own expense, to rectify the errors.
- I. All electrical equipment shall be capable of operating successfully at full-rated load, without failure, at an ambient air temperature of 40 degrees C, and specifically rated

for an altitude of 4700 feet.

- J. CONTRACTOR shall submit Shop Drawings, data and details to ENGINEER on all controls, fixtures, wiring, electrical equipment, conduit, etc. for review and acceptance prior to use of any components in the work.
- K. All materials, equipment, and parts comprising any unit or part thereof specified or indicated on the Plans shall be new and unused, of current manufacture, and of highest grade consistent to the state of the art. Damaged materials, equipment and parts are not considered to be new and unused and will not be accepted.

### **1.3 REGULATIONS AND CODES**

- A. Electrical Work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations of each of the following as well as all State and local codes.
  - 1. NATIONAL ELECTRICAL CODE (NEC)
  - 2. NATIONAL ELECTRICAL SAFETY CODE (NESC)
  - 3. INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)
  - 4. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
  - 5. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 6. INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
  - 7. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
  - 8. NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
  - 9. FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)
  - 10. UNDERWRITERS' LABORATORIES, INC. (UL).

### **1.4 COORDINATION OF THE ELECTRICAL SYSTEM**

- A. CONTRACTOR shall verify all actual equipment and motor full-load and locked-rotor current ratings. The necessary minimum equipment, wire, and conduit sizes are indicated on the Plans. If CONTRACTOR furnishes equipment of different ratings, CONTRACTOR shall coordinate the actual current rating of equipment furnished with the branch circuit conductor size, the overcurrent protection, the controller size, the motor starter, and the branch circuit overcurrent protection. The branch circuit conductors shall have a carrying capacity of not less than 125 percent of the actual full-load current rating. The size of the branch circuit conductors shall be such that the voltage drop from the overcurrent protection devices up to the equipment shall not be greater than 2 percent when the equipment is running at full-load and rated voltage.

### **1.5 TEST**

- A. The electrical Work shall be free from improper grounds and from short circuits. The correctness of the wiring shall be verified first by visual comparison of the conductor connections with connection diagrams. Individual circuit continuity checks shall next be made by using electrical circuit testers. Last, the correctness of the wiring shall be verified by the actual electrical operation of the electrical and mechanical devices. Any

deviation from the wiring indicated on the Plans or accepted Drawings shall be corrected and indicated on the Plans.

## **1.6 CONFORMS TO RECORD DOCUMENTS DRAWINGS**

- A. Prior to completion of the Contract, CONTRACTOR shall furnish ENGINEER with a set of Electrical Plans marked with any changes, deviations or additions to any part of the electrical work.
- B. Each conductor shall be identified as required by the Contract Documents. This identification shall be indicated on the Record Documents Drawings to enable rapid and accurate circuit tracing by maintenance personnel.

## **1.7 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 - SUBMITTAL PROCEDURES.

## **PART 2 PRODUCTS**

### **2.1 NAMEPLATES**

- A. Where indicated on the Plans and where required by applicable codes, CONTRACTOR shall furnish and install nameplates which shall be black lamicoid with white letters. The nameplates shall be fastened to the various devices with round head stainless steel screws. Each disconnect means for service, feeder, branch, or equipment conductors shall have nameplates indicating its purpose. All nameplates shall have 3/8-inch high lettering.

### **2.2 AUTOMATIC EQUIPMENT WARNING SIGNS**

- A. Permanent warning signs shall be mounted at all mechanical equipment which may be started automatically or from remote locations. Signs shall be in accordance with OSHA regulations and shall be suitable for exterior use. The warning signs shall be fastened with round head stainless steel screws or bolts, located and mounted in a manner acceptable to ENGINEER.
- B. Warning signs shall be 7 inches high by 10 inches wide, colored yellow and black, on not less than 18 gauge vitreous enameling stock. Sign shall read:

CAUTION  
THIS EQUIPMENT STARTS  
AUTOMATICALLY  
BY REMOTE CONTROL

## **PART 3 EXECUTION - Not Used**

- END OF SECTION -

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**SECTION 26 05 05**  
**ELECTRICAL AND INSTRUMENTS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section includes general electrical equipment used to complete the electrical system.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections:
1. Section 01 33 00 Submittal Procedures
  2. Section 26 05 00 Electrical General Requirements
  3. Section 26 05 13 Conductors and Cables
  4. Section 26 05 33 Raceway

**1.3 SUBMITTALS**

- A. Submittals will be required for all electrical equipment and shall be made in accordance with Section 01 33 00 Submittal Procedures.

**PART 2 MATERIALS**

**2.1 LIGHTING SWITCHES**

- A. Manufacturers:
1. **Hubbell 1221W (white)**
  2. **P&S 20AC1W (white)**
  3. **Leviton 1221-2W (white)**
  4. Or approved equal
- B. Industrial Extra Heavy-Duty Specification Grade: Snap switches shall have the number of poles as indicated on the Drawings, white, rated at 20 ampere.
- C. Device Cover Plates:
1. Indoor Industrial Areas: Stainless steel cover plates shall be utilized.
  2. Outdoor: Weatherproof cover plates.

**2.2 RECEPTACLES**

- A. Manufacturers:
1. **Hubbell IG5352W (white)**
  2. **P&S No. 5352-W (white)**
  3. **Leviton 8300-W (white)**
  4. Or approved equal

- B. Extra Heavy Duty Specification Grade: Outlets shall be duplex white receptacles and shall be 2-pole, 3-wire grounded, 125 volts, industrial, rated at 20 amperes.
- C. Special receptacles, covers, etc. shall be as specified herein or as indicated on the Plans.
- D. Device Cover Plates:
  - 1. Indoor Industrial Areas: Stainless steel cover plates shall be utilized.
  - 2. Outdoor: Weatherproof cover plates which also protect outlet when in use.
- E. Ground Fault Interrupter Receptacles (GFI): GFI outlets shall be duplex ivory GFI receptacles, 2-pole, 3-wire grounded, 125 volts AC, rated at 20 amperes.
  - 1. Manufacturers:
    - a. **Hubbell No. GF5262W**
    - b. **General Electric**
    - c. **P&S 2091-W**
    - d. **Leviton 5362-WGI**
    - e. Or approved equal.

## 2.3 TRANSFORMERS - DRY TYPE

- A. Manufacturers:
  - 1. **Acme Electric Corp.**
  - 2. **Federal Pacific Transformer Corp.**
  - 3. **Hevi-Duty Electric**
  - 4. **General Electric Co.**
  - 5. **Square D Co.**
  - 6. Or approved equal.
- B. Transformers shall be of the premium high efficiency quiet type and shall be installed where indicated on the Plans. The primary winding of the transformers shall have two 2-1/2 percent taps above and below normal.
- C. The transformers shall have a BIL of 10 kV with a temperature class of 185 degrees C for transformers up to 25 kVA and a temperature class of 220 degrees C for transformers rated at 30 kVA and larger.
- D. The sound level shall not exceed 44 dBa measured at 5 feet from the transformers after installation. Core and coil assemblies 30 kVA and larger shall be mounted on rubber vibration isolators designed specifically to reduce 120 HZ sound and multiple harmonics.

## 2.4 DISCONNECT SWITCHES (INDIVIDUAL)

- A. Manufacturers:
  - 1. **Eaton.**

2. **General Electric Co.**
  3. **Siemens, Inc.**
  4. **Square D Co.**
  5. Or approved equal.
- B. Disconnect switches shall be heavy-duty safety switches with a quick-make, quick-break operating mechanism, full cover interlock and indicator handle. The disconnect switches shall be furnished with fuses of the size indicated on the Plans. One set of spare fuses shall be furnished for each fused disconnect switch.

## **2.5 ENCLOSURES**

- A. Manufacturers:
1. **Hammond**
  2. **Hoffman**
  3. **Rittal**
  4. Or approved equal.
- B. This Specification includes enclosures to house electrical controls, instruments, terminal blocks, etc. If not indicated otherwise they shall be NEMA 12 for indoor and NEMA 3R for outdoor installations.
- C. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil-resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be of stainless steel. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket.
- D. Enclosures shall be from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin.
- E. Finish - Steel: Finish shall be white enamel interior, light grey enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

## **2.6 CIRCUIT BREAKERS - LOW VOLTAGE (INDIVIDUAL)**

- A. Manufacturers:
1. **Eaton, Cutler-Hammer**
  2. **General Electric**
  3. **Siemens**
  4. **Square D Company**
  5. Or approved equal.
- B. All circuit breaker frame and trip ratings shall be as indicated on the Plans, except that they shall be coordinated with the ratings of the equipment actually furnished and shall be modified where necessary to suit this equipment. Circuit breakers to be used in

motor control centers shall be as indicated on the Plans. When no indication of type is given on the Plans, the following shall govern:

1. Circuit breakers protecting motors rated 7.5 horsepower or less shall be motor circuit protectors, all other circuit breakers shall be molded case circuit breakers.

## 2.7 FULL-VOLTAGE, NON-REVERSING MOTOR CONTROLLERS

### A. GENERAL

1. Provide each motor with a suitable controller and devices that will function as specified for the respective motors and meeting NEMA ICS 2, the NEC, and UL.
2. Provide each motor controller with thermal overload protection in all ungrounded phases. Use protection consisting of thermal overload relays meeting NEMA ICS 2 which are sensitive to motor current and mounted within the motor controller, or a combination of thermal protectors embedded within the motor windings and controller-mounted overload relays, as indicated. Use overload protection devices of the inverse-time-limit type.
3. Provide controller-mounted overload relays of the manual-reset type with externally operated reset button when used without motor thermal protectors; when used in conjunction with thermal protectors, provide the automatic reset type. Select and install overload relay heaters after the actual nameplate full-load current rating of the motor has been determined.
4. Install and connect any required thermal protector monitoring relay provided by motor manufacturer in motor-control circuit and provide manual reset function. Fuse thermal-protector circuits according to the manufacturer's recommendations.
5. The Booster Pump controller shall be provided with two sets of thermal overload devices, rated for the full load current of the existing motors. The controller shall have a selection switch on the front selecting which thermal overload will be in service.

### B. FULL VOLTAGE MAGNETIC STARTERS

1. Provide starters meeting NEMA ICA 2, Class A, with the rating and enclosure shown.
2. Supply individual control power transformers where indicated. The transformers shall have sufficient capacity to serve the connected load and limit voltage regulation to 10-percent during contact or pickup. Fuse one side of the secondary winding and ground the other side. Provide primary, current limiting fuses on all control power transformers.
3. Provide a panel type voltmeter, nominal 4-1/2 inch model with 3-phase, OFF four position selector switch.
4. Provide a panel type ammeter, nominal 4-1/2 inch model with 3-phase, OFF four position selector switch, C.T.'s with proper ratio.
5. For nonhazardous, indoor, dry locations, provide heavy-duty, indicating lights, selector switches, and stations. **Utilize General Electric Type CR 104P, or equivalent by Square D, Eaton, or other acceptable manufacturer.** Acceptable manufacturer. The use of other manufacturer's names referenced

to materials herein, shall indicate the quality of material to be provided.

## 2.8 FUSES, 0-600 VOLTS

- A. Provide a complete set of current-limiting fuses wherever fuses are indicated. Supply a set of six spare fuses of each type and each current rating installed. Utilize fuses that fit mountings specified with switches and which provide features rejecting Class H fuses. Provide the following types:
1. For 0- to 600-volt motor and transformer circuits, 0- to 600 amps, UL Class RK-1 with time delay, **Bussmann** Type LPS-RK, **Shawmut** Type A6D, or equal.
  2. For 0- to 250-volt motor and transformer circuits, 0- to 600 amps, UL Class RK-1 with time delay, **Bussmann** Type LPN-RK, **Shawmut** Type A2D-R, or equal.
  3. For 0- to 600-volt feeder and service circuits, 0 to 600 amps, UL Class RK-1, **Bussmann** Type KTS-R **Shawmut** Type A6K-R, or equal.
  4. For 0- to 250-volt feeder and service circuits, 0 to 600 amps, UL Class RK-1, **Bussmann** Type KTN-R, **Shawmut** Type A2K-R, or equal.

## 2.9 MODULAR OVERLOAD RELAYS

- A. Where called for on the Plans, modular overload relays shall be provided with the motor starters. The modular overload relays shall be 3-pole solid state devices set by one plug-in heater and shall protect all 3 phase of the motor in ambient temperatures ranging from -20 degrees to +70 degrees C.
- B. The jam modules shall plug in the modular overload relays and shall provide for instantaneous trip of the overload relay should the current exceed a preset value at any time after the motor has accelerated. The modules shall be adjustable to any value between the 150 percent and 400 percent of the motor full-load current.
- C. The underload modules shall plug in the MOR and shall provide for overload relay trip whenever the current falls below a set value after the motor has accelerated. The modules shall be adjustable between 50 percent and 90 percent of the full load value of the motor full load current.

## 2.10 LIGHTING

- A. Lighting fixtures shall be as described below and as indicated on the Plans.
- B. Fixtures shall include lamps, ballasts, poles, mounting hardware, etc. to provide complete operating units.
- C. Catalog data including applicable coefficients of utilization tables, isolux chart of illumination on a horizontal plane, beam efficiency, horizontal and vertical beam spread, and beam lumens shall be submitted to the ENGINEER for review and acceptance for all fixtures before fixtures are manufactured. Substitutions will be permitted only if acceptable to the ENGINEER.

#### D. Light Emitting Diode(LED) Lighting

1. The LED Fixture shall consist of a LED Luminaire Assembly, LED Driver and mounting hardware.
2. LED Fixture requirements are as described below:
  - a. The input to the LED Lighting Fixture shall be 120 to 277VAC ( $\pm 10\%$ ), 60HZ or as indicated in the Contract Document.
  - b. Correlated Color Temperature (CCT) shall be minimum 4000K or as indicated in the Contract Document.
  - c. Color Rendering Index (CRI) shall be 70.
  - d. A minimum of 50,000 operating hours before reaching the L70 lumen output degradations point without catastrophic failure, or as indicated in the Contract Document.
  - e. Conform with UL 8750.
  - f. Compliance to FCC CFR Section 15.
3. LED Luminaire Assembly
  - a. Definition: Luminaire Assembly is the LED assembly without LED driver.
  - b. Input voltage shall be 24VDC, 36VDC or as indicated in the Contract Document.
  - c. CCT, CRI, Minimum life and UL conformity requirements are as defined in above.
4. LED Driver
  - a. Must operate input voltage between 120VAC to 277VAC ( $\pm 10\%$ ).
  - b. Operating frequency must be 60Hz.
  - c. Must be rated to operate between  $-40^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ .
  - d. Must have a minimum efficiency of 85%.
  - e. Self protected including short circuit protection.
  - f. Compliance to FCC CFR Section 15.
  - g. Driver must have a Power Factor (PF) of 0.90.

E. Types and ratings: As shown on "Lighting Fixture Schedule" on Drawings.

## 2.11 CONTROL PANELS

#### A. ENCLOSURES

1. Manufacturers:
  - a. **Hammond Manufacturing**
  - b. **Nvent Hoffman, Inc.**
  - c. **Rittal North America, LLC**
  - d. Or approved equal.
2. This specification includes enclosures to house electrical controls, instruments, terminal blocks, etc. If not indicated otherwise they shall be NEMA 12 for indoor and NEMA 3R for outdoor installations.
3. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil-resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be stainless steel. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket.

4. Enclosures shall be from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin.
5. Finish - Steel: Finish shall be white enamel interior, light grey enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

#### B. PILOT DEVICES:

1. Manufacturers:
  - a. **Allen-Bradley, Bulletin 800T, 30 mm**
  - b. **Eaton**
  - c. **General Electric**
  - d. **Square D, Type K, 30 mm - Class 9001**
  - e. Or equal.
2. Indicating lights, pushbuttons and selector switches shall be miniature oiltight units. Contact blocks in control circuits shall be NEMA ICS, B150, rated 5 amperes inductive at 120 volts AC. Contact blocks for signal circuits shall be rated 0.06 amperes at 30 volts AC or DC and shall be hermetically sealed and reed switches. Pilot lights for 120 volt AC circuits shall be LED type. Where group lamp test circuits are not specified, individual pilot light assemblies shall be "push-to-test" type. Pilot lights shall be capable of being changed from the front of the panel without special tools.

#### C. TERMINAL BLOCKS:

1. Manufacturers:
  - a. **Allen-Bradley**
  - b. **Buchanan**
  - c. **Eaton**
  - d. **Entrelec (ABB) M4/6**
  - e. **Square D Co.**
  - f. **Weidmuller**
  - g. Or equal.
2. Terminal blocks shall be of the size required for conductors therein and a minimum of 50 percent spares shall be provided in each terminal box.
3. Provide only screw type terminals.

#### D. FUSE BLOCKS:

1. Manufacturers:
  - a. **Entrelec (ABB), M10/13.SF2**
  - b. Or approved equal.
2. DIN rail mounted.
3. Terminals shall accommodate 22-10 AWG solid or stranded wires.
4. Provide terminals rated for 600 VAC/VDC and 15 amperes.
5. Device shall be UL listed.

#### E. TIMING RELAYS:

1. Manufacturer:
  - a. **Allen-Bradley,**
  - b. **Square D Company**
  - c. Approved equal.
2. Timing relays shall be heavy-duty industrial 600 volt, 10 amperes.

#### F. CONTROL RELAYS:

1. Manufacturer:
  - a. **Idec RH series.**
  - b. **Allen-Bradley**
  - c. Or equal.
2. Control relays shall be general purpose "midget" relays, 10 ampere contact rating, with 1, 2, 3 or 4 Form C contacts as shown on the Drawings.
3. Relay shall be provided with blade style terminals.
4. Provide LED indicator light with relay.
5. Provide a standard DIN rail mount relay socket.
6. Relay life expectancy shall be in excess of 500,000 operations at 120 VAC.
7. Device shall be UL listed.

#### G. ELAPSED TIME COUNTER

1. Manufacturer
  - a. **Allen Bradley**
  - b. **Eaton**
  - c. **Square D Company**
  - d. **Siemens**
  - e. Or equal
2. Provide a panel mounted elapsed time counter with a minimum of 4 digits plus 0.1 hour indication.
3. Unit shall operate on 120 VAC.
4. Non-resettable.

#### H. DIN RAIL CIRCUIT BREAKERS

1. Manufacturer/Model:
  - a. **Eaton/FAZ-NA**
  - b. **LS Electric**
  - c. Approved Equal.
2. DIN Rail mounted.
3. Trip Characteristics: UL C or D.
4. UL Listed under UL 489.
5. Dual rated for AC or DC applications.
6. Single-pole, two-pole or three-pole models.
7. Current limiting design.
8. Thermal-magnetic overcurrent protection.
9. Trip-free design.

#### I. DC POWER SUPPLY



1. Manufacturer/Model:
  - a. **IDEC/PS5R-S**
  - b. **Rhino/PSB**
  - c. Or Approved Equal.
2. Input: 85-264 V AC, 50/60 Hz.
3. Output: 24 V DC, Adjustable voltage range:  $\pm 10\%$ .
4. Mounting: DIN rail mounting.
5. Temperature:
  - a. Operating: -10 to +65 deg C
  - b. Storage: -25 to +75-deg C.
6. IP20 finger safe
7. UL Listed.

#### J. DC CAPACITOR UNINTERRUPTIBLE POWER SUPPLY

1. Manufacturer/Model:
  - a. **Altech Corporation/C-TEC C-TEC2410-10**
  - b. No Equal.
2. Power:
  - a. Nominal Input Voltage: 24VDC  $\pm 12.5\%$
  - b. Maximum Nominal Input Current: 10A.
  - c. Nominal Output Voltage: 24V
  - d. Nominal Output Current: 10A
3. Energy Content: 10 KJ
4. Enclosure: IP20
5. Operating Temperature: -40-deg C to 60-deg C.
6. Storage Temperature: -40-deg C to 60-deg C.
7. Relative Humidity: 95% non-condensing
8. Maximum Altitude: 2000 meters
9. Mounting: 35 mm DIN rail.

## 2.12 INSTRUMENTATION

### A. PRESSURE TRANSMITTER

1. Manufacturer/Model:
  - a. **PMC STS / ATM/T**
  - b. No Equal.
2. Electronic pressure measurement device tailored to the installation as shown on the drawings and suitable for the planned application shall be installed. The transducer shall include a integral ceramic diaphragm such that a change in pressure is measured by a change in capacitance. The pressure transmitter shall operate on 24 VDC.
3. The unit shall measure system pressure and have a 4-20 mA DC signal output.
4. Process connection: 304 SS, 1/2-inch MNPT with 1/4" FNPT or PT 1/2" male thread.
5. Range:
  - a. PT-1, PT-2, PT-3: 0-200 PSIG

### B. TEMPERATURE TRANSMITTER

1. Manufacturer/Model:
  - a. **Pribusin, Inc/TWTS-5**
  - b. Or approved equal
2. Loop powered two-wire temperature sensor/transmitter that mounts on a single-gang outlet box. Provide 4-20 mA DC output.
3. Range: 0 to +150 deg F., Accuracy: +/- 1 Deg, C or +/- 2 Deg F.
4. Application:
  - a. TT-1: Pump room temperature transmitter.
  - b. TT-2: Chlorine room temperature transmitter.

## 2.13 PROCESS SWITCHES

### A. LEVEL SWITCH - FLOAT

1. Manufacturer/Model:
  - a. **IMO Industries, Inc. Gems Sensors Division, 1702.**
  - b. Or approved equal.
2. Stem: 316 Stainless steel
3. Float: Buna N
4. Operating Temperature:
  - a. Water: to 180-degrees F.
5. Minimum Liquid Specific Gravity: .65
6. Pressure (MAX): 150 PSI
7. Switch Rating: 20 VA
8. Electrical Termination: No. 22 AWG, 24-inches long, Polymeric Lead Wires.
9. Selectable Normally Open (NO) or Normally Closed (NC) by inverting float on unit stem.
10. Application:
  - a. LSH-1, Floor high water switch.

### B. PRESSURE SWITCH

1. Manufacturer:
  - a. **Mercoide: Model DAW-33-153-7**
  - b. Approved equal.
2. Brass bourdon tube material
3. Switch: SPDT, closes on increase pressure, 10A120 VAC, Adjustable Deadband.
4. Application:
  - a. PSL-1 thru PSL-3: 2-60 Adjustable Operating Range. 3 PSIG Minimum Deadband.
  - b. PSH-1 thru PSH-3: 10-200 PSIG Adjustable Operating Range. 8 PSIG Minimum Deadband.

## 2.14 MISCELLANEOUS

### A. HATCH POSITION SWITCH

1. Manufacturer:
  - a. **Square D Company**

- b. Or approved equal.
- 2. Heavy duty turret head lever arm type switch. Provide a offset type lever arm with sufficient length to contact hatch lid.
- 3. Rated NEMA 6P
- 4. Rated: 120 VAC, 6 amps.
- 5. Application:
  - a. ZS-1 thru ZS-7:Roof Hatch

#### B. MAGNETIC DOOR SWITCH (MAN-DOOR)

- 1. Manufacturer
  - a. **Ademco, 7939GY**
  - b. **Edwards, Model 60**
  - c. **GE 2505A**
  - d. Substitutions: Refer to Section 01 60 00 Product Requirements
- 2. Provide a gray Normally Open (NO) magnetic door switch, where the switch closes when the magnet engages. Provide appropriate hardware to install on door.
- 3. Application:
  - a. ZS-8, ZS-9A/9B, ZS-11, ZS-12A/12B: Door position switches.

#### C. MAGNETIC DOOR SWITCH (ROLL-UP DOOR)

- 1. Manufacturer/Model:
  - a. **Ademco, 960**
  - b. **Sentrol Inc., P/N 2505A**, with mounting brackets P/N 1912 and 1940.
  - c. Substitutions: Refer to Section 01600 - Product Requirements
- 2. Provide a epoxy sealed door Normally Open (NO) magnetic door switch, where the switch closes when the magnet engages. Provide appropriate hardware to install on floor and door.
- 3. Application:
  - a. ZS-10: Pump Room roll-up door.

### PART 3 INSTALLATION

#### 3.1 INSTALLATION

- A. Install all component and instrumentation as required by each manufacturer.

- END OF SECTION -

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**SECTION 26 05 13**  
**CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Installation of wires or cables required for power distribution, service, feeders, and branch circuits.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections:
  - 1. Section 26 05 05 Electrical Equipment
  - 2. Section 26 05 33 Raceway
  - 3. Section 25 05 34 Electrical Boxes and Fittings
  - 4. Section 31 23 15 Excavation and Backfill for Buried Pipelines

**1.3 REFERENCES**

- A. NFPA 70: National Electrical Code.
- B. UL: Underwriters' Laboratories, Inc.

**1.4 SUBMITTALS**

- A. Field Test Data: Submit megohmmeter test data for circuits under 600 volts.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Building Conductors: Copper, 600 Volt insulation, THW.
- B. Branch Circuit Conductors and All Conductors #3 AWG and Smaller: Copper conductor, with TW, THHN, or THWN insulation #10 AWG and smaller, and THW larger than #10 AWG, where ambient temperature conditions exceed 140 degrees F.
  - 1. Size all conductors per NFPA 70.
  - 2. Minimum size to be #12 AWG.
  - 3. Stranded conductors for #8 AWG and larger.
  - 4. For outlets to fixtures, and in fixture channels (in dry areas); THHN insulated conductor.
  - 5. In damp locations, under slabs, on exterior provide THWN.
- C. Provide permanent plastic name-tag indicating load feed.
- D. Use type XHHW conductors for water pumping and regulator stations.

E. Cable Supports: OZ cable supports for vertical risers, type as required by application.

## **2.2 INSTRUMENTATION**

- A. Instrumentation cable shall have the number of twisted pairs indicated on the Plans and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be No. 16 AWG minimum.
- B. The jacket shall be flame retardant Flamenal or Okoseal, 90 degrees C temperature rating. The cable shield shall be minimum of 2.3 mil aluminum or copper tape overlapped to provide 100 percent coverage and a tinned copper drain wire.
- C. The conductors shall be bare soft annealed copper, Class B, 7 strand minimum concentric lay with Okoseal or Vulkene, 15 mils nominal thickness, nylon jacket, 4 mil nominal thickness, 90 degrees C temperature rating. One conductor within each pair shall be numerically identified.

## **2.3 MODBUS RS485 CABLE**

- A. Manufacturers/Model
  - 1. Belden 9841
  - 2. Or approved equal
- B. Provide low-capacitance computer cable for EIA RS-485 signal transmission. Cable shall be AWG#24 stranded (7x32), with polyethylene insulation, twisted-pairs with overall shield (100% coverage) and #24 AWG drain wire.

## **2.4 VFD CONDUCTORS**

- A. Manufacturers:
  - 1. 250 HP Motor: Belden 29535 (500 kCMIL)
  - 2. 100 HP Motor: Belden 29535 (2/0 AWG)
  - 3. Approved Equal
- B. Provide 3 conductor plus (3) symmetrical bare copper circuit conductors plus (2) spiral copper tape shields (100% coverage) with PVC insulation, XLPE insulation. Provide a 100% foil plus dual copper tape shield. Cable shall be sun and oil resistant.
- C. Cable shall be suitable for Variable Frequency Drives.
- D. Cable shall be suitable for indoor installation.

## **2.5 ETHERNET CABLE**

- A. Ethernet, Cat 6
  - 1. Manufacturer:

- a. **Belden 7953A**
  - b. Or Approved Equal.
- B. 4 pair Category 6 shielded twisted pair cable. Constructed with #23 AWG solid bare copper conductors polyethylene or polypropylene insulation, and a black sunlight resistant PVC jacket with ripcord under the jacket for use in general communications applications.
- C. Characteristics:
  - 1. Jacket Diameter: 0.258-inches.
  - 2. Jacket Material: PP (Polypropylene)
  - 3. Cable Weight: 44 lbs/1000ft.
  - 4. Temperature Rating: -40 to 75-deg C
  - 5. Conductor Color Code:
    - a. Pair 1 - Blue & White/Blue
    - b. Pair 2 - Orange & White/Orange
    - c. Pair 3 - Green & White/Green
    - d. Pair 4 - Brown & White/Brown

## **2.6 COLOR AND CODING OF CONDUCTORS**

- A. 120/240 volt.
  - 1. A-Phase - Black
  - 2. B-Phase - Red
  - 3. Neutral - White
  - 4. Ground - Green
- B. 480Y/277 volt.
  - 1. A-Phase - Brown
  - 2. B-Phase - Orange
  - 3. C- Phase - Yellow
  - 4. Neutral - White
  - 5. Ground - Green

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Make conductor length for parallel feeders identical.
- B. Lace or clip groups of feeder conductors at distribution center, pull-boxes, and wireway. Neatly arrange wiring within cabinets, junction boxes, fixtures, etc.
- C. Provide copper grounding conductors and straps.
- D. Install wire and cable in code conforming raceway.

- E. Use non-detrimental wire pulling lubricant for pulling No. 4 AWG and larger wire.
- F. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits.
- G. Color code conductors to designate neutral conductor and phase.
- H. Furnish necessary reels, reel jacks, and other pulling aids required to prevent damage to wires and cable.
- I. Splicing:
  - 1. Install wires and cables continuous without splices from sources of supply to distribution equipment and from source of supply to motor, lighting, or power outlet.
  - 2. Do not use pull boxes for making splices.
  - 3. Do not install splices in conduits.
- J. Install all wiring per NFPA 70.
- K. Use of cable with more conductors than specified; CONTRACTOR's option. When done, tape off and labeled extra conductors as spares.

### **3.2 CONDUCTOR CONNECTIONS**

- A. Use approved pressure type solderless connectors and lugs for service entrance, feeder, equipment connections and terminal posts.
- B. Use connectors of a type compatible to conductors, locations, and load.
- C. Make neutral connection and taps individually in order to prevent the possibility of an "open-neutral".
- D. Make branch circuit connections with UL approved solderless connectors. Do not depend solely upon a single insulating material to secure connection as well as to insulate it.
- E. After first either silverplating the bars or applying suitable non-oxidizing agents, bolt buss bar connections with adequate nonferrous bolts, washers, and lockwashers.
- F. Insulate joints and taps with patented or molded plastic insulators. Use tapes compatible with conductor jackets, temperature, and other conditions.

### **3.3 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW**

- A. Prior to energization, test cable and wire for continuity of circuit for short circuits. Megger all circuit of 100 amp and greater rating.
- B. Correct malfunctions.



C. Submit record of megaohmmeter readings to ENGINEER.

### **3.4 IDENTIFICATION OF FEEDERS**

- A. Affix a marker stamped or embossed on each cable at each entry to and exit for each manhole, pullhole, pullbox, cable tray switchgear and switch, identifying circuit; i.e. "MCCI", "PANEL L" "NO 1" etc.
- B. Identification letters to be 1/8 inch size minimum.
- C. Markers to be rigid, noncorrosive, attached to feeder cables with feeder identification.
- D. Nylon straps to be used to tie the markers.

- END OF SECTION -

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**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES:**

- A. Grounding of Electrical Systems and Equipment.
  - 1. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

**1.2 RELATED SECTIONS AND REFERENCES:**

- A. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables.

**1.3 SUBMITTALS**

- A. Submit "Letter of Conformance" in accordance with Section 01 33 00 indicating specified items selected for use in Project with the following supporting data:
  - 1. Product Data: For the following:
    - a. Ground rods.

**1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Comply with UL 467.
- B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Approved Manufacturers:
  - 1. Grounding Conductors, Cables, Connectors, and Rods:
    - a. **Chance/Hubbell (573-682-5521)**
    - b. **Copperweld Corp. (931-433-7177)**
    - c. **Thomas & Betts, Electrical (800-816-7809)**
    - d. Approved equals.

**2.2 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Section 26 05 13 - Conductors and Cables.
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B3.
  - 2. Assembly of Stranded Conductors: ASTM B8.
  - 3. Tinned Conductors: ASTM B33.
- H. Copper Bonding Conductors: As follows:
  - 1. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
  - 2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- I. Equipment Ground Conductor (Green) shall be included with all circuit conductors. In addition, provide a neutral conductor where applicable.

## **2.3 CONNECTOR PRODUCTS**

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

## **2.4 GROUNDING ELECTRODES**

- A. Ground Rods: copper-clad steel. Size: 120" long by 3/4" in diameter.
- B. UFER: 25-feet of bare copper conductor installed in the footing or foundation wall. Connect copper to structural support steel.
- C. Metal Water Pipes: Where metal water piping is used, provide grounding electrode conductor to metal water piping. Use UL listed connection devices as required.
- D. Building Grounding Ring: AWG #4/0 Bare copper.

## **PART 3 EXECUTION**

### **3.1 APPLICATION**

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
  - 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

### **3.2 EQUIPMENT GROUNDING CONDUCTORS**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- E. SCADA RTU: For signal and data, systems, provide No. 4 AWG minimum insulated grounding conductor from grounding electrode system to the SCADA RTU.

### **3.3 INSTALLATION**

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
  - 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: If metal water pipe is installed, provide 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 by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: If metal water piping is used, use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

### **3.4 CONNECTIONS**

- A. General: Make connections so galvanic action or electrolysis possibility 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 to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Non-contact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

- E. Tighten screws and bolts for grounding and bonding 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 .
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### **3.5 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests, by the fall-of-potential method according to IEEE 81.
  - 3. Provide drawings locating each 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.
    - a. Equipment Rated 500 kVA and Less: 10 ohms.
    - b. Manhole Grounds: 10 ohms.
  - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner representative promptly and include recommendations to reduce ground resistance.

- END OF SECTION -

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**SECTION 26 05 33**  
**RACEWAY**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Flexible or rigid conduits, couplings, supports, and nonmetallic ducts.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections:
  - 1. Section 26 05 13 Conductors
  - 2. Section 26 04 34 Electrical Boxes and Fittings
  - 3. Section 33 23 15 Excavation and Backfill for Buried Pipelines.

**1.3 REFERENCES**

- A. ANSI C80.1: Rigid Steel Conduit - Zinc-Coated.
- B. ANSI C80.3: Electrical Metallic Tubing - Zinc-Coated.
- C. FS W-F-406: Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible.
- D. FS WW-C-566: Conduit, Metal, Flexible.
- E. NEMA TC6: PVC and ABS Plastic Utilities Duct for Underground Installation.
- F. NEMA TC9: Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.
- G. NFPA 70: National Electric Code.
- H. UL: Underwriters' Laboratories, Inc.

**PART 2 PRODUCTS**

**2.1 METAL CONDUIT AND TUBING**

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4 inch.
- B. Rigid Metal Conduit (RMC): ANSI C80.1.
- C. Intermediate Metal Conduit (IMC): ANSI C80.1.
- D. Rigid and Intermediate Steel Conduit Fittings: Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at conduit termination, use OZ Type B bushings

on conduits 1-1/4 inch and larger.

- E. Electrical Metallic Tubing (EMT): ANSI C80. 3.
- F. EMT Fittings: Provide insulated throat non-indenter type malleable steel fittings; concrete tight where required by application. Install OZ Type B bushings on conduits 1-1/4 inches and larger.
- G. Flexible Metal Conduit (FMC): FS WW-C-566, Zinc-coated steel.
- H. Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 1, Style A.
- I. Liquid Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- J. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type1, Class 3, Style G.
- K. Expansion Fittings: OZ Type AX, or equivalent to suit application.
- L. PVC Coated RGS Conduit:
  - 1. Requirements of article "Rigid Metal Conduit - Steel (RGS)" shall apply.
  - 2. Coating: Apply minimum 40-mil, gray polyvinyl chloride (PVC) coating over exterior and apply urethane coating uniform and consistent to interior of conduit. Internal coating shall be nominal 2 mil thickness. Conduit having areas with thin or no coating, not acceptable. Protect conduit threads by urethane coating. PVC coating shall have been investigated by UL as providing primary corrosion protection for rigid metal conduit.

## **2.2 NON-METALLIC CONDUIT AND DUCTS**

- A. General: Minimum trade size: 3/4 inch.
- B. Underground PVC Plastic Utilities Duct: NEMA TC6, Type I for encased burial in concrete, Type II for direct burial.
- C. Duct Fittings: NEMA TC9, match to duct type and material.

## **2.3 CONDUIT, TUBING, AND DUCT ACCESSORIES**

- A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

## **2.4 LOCKNUTS, BUSHINGS, CONNECTORS, COUPLINGS, AND SUPPORTS**

- A. General: Provide malleable bushings, except that plastic bushings may be used in lieu of phenolic-lined malleable bushings where "insulating bushings" are required.

- B. Provide "double-locknut" system (2 locknuts) throughout, each being tightened wrench tight as to effectively bond outlet box or cabinet to conduit.
- C. Sealing Bushing: OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.
- D. Provide insulated-through type ground bushing of the malleable type.
- E. Provide connectors or couplings that are proper for the conduit they are used with. Make watertight when required.
- F. Provide cadmium plated or galvanized fittings.
- G. Provide fittings with die-cut threads unless approved otherwise.
- H. EMT connectors used with #4 and larger cable shall have throat liners of suitable plastic insulation.

## **2.5 CONDUIT OUTLET BOXES**

- A. Refer to Section 26 05 34 Electrical Boxes and Fittings.

## **2.6 SCHEDULE OF LOCATIONS**

- A. Indoor:
  - 1. Exposed: Ridged, threaded galvanized steel conduit.
  - 2. Concealed Spaces: EMT conduit may be used.
  - 3. Attic Spaces: MC Cable may be used for lighting circuits only.
  - 4. Below Slab: PVC Sch. 40, with all concrete floor penetrations PVC coated GRS. Tapping GRS conduit shall not be permitted.
  - 5. Wall Penetrations: Wall penetrations PVC coated GRS, as shown on the drawings. Tapping GRS conduit shall not be permitted.
  - 6.
- B. Exterior:
  - 1. Exposed: Ridged, threaded galvanized steel conduit.
  - 2. Below Grade: Solvent welded PVC Sch. 40, with all concrete sidewalk penetrations with PVC coated GRS.
- C. Make connections to motors and equipment with PVC jacketed flexible conduit and liquid tight connectors. Provide 1/2 inch minimum size for motor connections.
- D. Provide flexible conduit for fixture and control wiring with sufficient length of flexible conduit to avoid transmission of vibration.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Excavate; Section 31 23 16 Excavation and Backfill for Buried Pipelines.

### **3.2 INSTALLATION**

- A. Install conduit concealed in all areas, excluding mechanical and electrical rooms, connections to motors, and connections to surface cabinets.
- B. For exposed runs attach surface-mounted conduit with clamps.
- C. Coordinate installation of conduit in masonry work.
- D. Unless indicated otherwise, do not install conduit larger than 2-1/2 inches in concrete slabs. Provide a minimum concrete cover around conduits of 2-inches.
- E. Install conduit free from dents and bruises. Plug ends to prevent entry of dirt and moisture.
- F. Clean out conduit before installation of conductor.
- G. Alter conduit routing to avoid structural obstructions, minimizing crossovers.
- H. Fill end of conduit with fiberglass where conduits leave heated area and enters unheated area.
- I. Provide flashing and pitchpockets, making watertight joints where conduits pass through roof or waterproofing membranes.
- J. Install UL approved expansion fittings complete with grounding jumpers where conduits cross building expansion joints. Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above suspended buildings.
- K. Route all exposed conduits parallel or perpendicular to building lines.
- L. Make interconnections between difference types of raceways with manufactured fittings approved by UL.
- M. Size raceways per NFPA 70 tables. Do not reduce from any sized indicated.
- N. Do not exceed sizes permitted in slabs or walls.
- O. Do not exceed number of bends allowed in conduit by NFPA 70.
- P. Make joints wrench tight or otherwise with minimum resistance to the flow of fault currents.

- Q. Use furred spaces and chases to an advantage in concealing conduits.
- R. Make field bends only where needed and then carefully to minimize wire pulling tensions and for best appearance in exposed runs.
- S. Test conduit runs with lignum vitale ball (mandrel) of 85-percent of conduit diameter.
- T. Cut conduit with hacksaw or other approved pipe cutting tool and ream ends to clean out all burrs before connecting.
- U. Keep conduits at least 6-inches away from steam or hot water pipes, breaching, and boilers, but in no case permit conductors to reach higher than rated temperatures. Avoid traps in runs and slope conduit to drain.
- V. Fasten raceways securely in place. Firmly fasten conduit within 3-feet of each outlet, junction box, cabinet, or fitting. Support metallic conduit, rigid (heavy wall) and EMT at least every 10-feet. Support rigid nonmetallic conduit in strict accordance with NFPA70. Use raceway fasteners designed for the purpose.

### **3.3 SPECIAL CONDUIT FITTINGS**

- A. Use special conduit fittings as required or indicated. Use UL approved fittings suitable for location and usage made.
- B. At expansion joints use special fittings if cast in concrete slabs.
- C. Building Expansion Joints: Where surface conduits, raceways, panels, or light fixtures, span building expansion joints, make satisfactory arrangements to provide the movement provided for in building structure plus or minus nominal joint width.

### **3.4 PULL BOXES, WIREWAYS, AND GUTTERS**

- A. Furnish as indicated, plus any such items required to assemble conduits and other raceways. Provide Section 26 05 34 Electrical Boxes and Fittings as dictated by wire pulling requirements. Unless indicated otherwise face into secondary or unfinished rooms.
- B. Construction: Code gage galvanized sheet steel and sized strictly in conformance with NFPA 70 requirements.
- C. Finish: Free of burrs, sharp edges, unreamed holes, and sharp-pointed screw or bolts. Paint both inside and out.
- D. Coating: When mounted direct to concrete or masonry walls that are below grade or where there will be sweating or other moisture present on wall surface, coat backs of boxes with a heavy coat of black asphalt paint before mounting.
- E. Protection: Adequate provisions for preventing damage to conductors either during pulling in or from weights and tensions when in place.

- F. Weatherproof, rain-tight, or special type when indicated or when required by NFPA 70.

### **3.5 ANCHORS, FASTENERS, AND MISCELLANEOUS SUPPORTS**

- A. Use compatible anchors in roof or ceiling slabs of concrete from which a load is suspended and anchors used to fasten heavy equipment without lead in their construction.
- B. Make exposed conduit fastenings with one-piece, malleable conduit clamps. Two hole, galvanized sheet metal pipe straps may be used on all concealed installations.
- C. Use companion bases or backs with conduit clamps when conduit is exposed to weather or continuous moisture.
- D. Use ring type hangers on individual runs of conduit 3-inches and larger if suspended, complete with threaded rods. Use adjustable turnbuckles when specified or otherwise as an option.
- E. Support multiple runs of suspended conduits from trapeze style hangers suspended with rigid threaded steel rods and with suitable conduit clamps or straps of the same make as cross channels used.
- F. Mount multiple runs of conduit on ceiling or wall surfaces.
- G. Do not hang or support electrical equipment and materials from roof decks.

- END OF SECTION -

**SECTION 26 05 34**  
**ELECTRICAL BOXES AND FITTINGS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Types of electrical boxes and electrical fitting work.

**1.2 REFERENCES**

- A. NEMA OS 1: Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- B. NEMA OS 2: Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
- C. NFPA 70: National Electric Code.
- D. UL: Underwriters' Laboratories, Inc.

**1.3 QUALITY ASSURANCE**

- A. Comply with NFPA 70 as applicable for installation of electrical boxes and fittings.
- B. Comply with NEMA OS 1 and NEMA OS 2 as applicable for outlet boxes, device boxes, covers and box supports.
- C. Provide electrical boxes and fittings which have been UL-listed and labeled.

**PART 2 PRODUCTS**

**2.1 INTERIOR OUTLET BOXES**

- A. One piece, cast iron or cast aluminum outlet wiring boxes, of types shapes and sizes, including box depths, to suit each respective location and installation. If of aluminum, essentially "copper free". Do not use on conduits of dissimilar metals, except with written permission.
- B. Construct with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices.
- C. Minimum depth 1-1/4 inches or 2-1/8 inch depth for boxes with 3 or more conduit entries.
- D. Use in combination with factory or field bends when indicated or advised. Complete outlet bodies with mounting brackets, hangers, extension rings, fixture studs, cable clamps, metal straps, gaskets, cover, hubs, reducers, and other accessories.

## **2.2 WEATHERPROOF OUTLET BOX**

- A. Corrosion-resistant cast-metal of types, shapes and sizes (including depth) required.
- B. Threaded conduit ends, cast-metal face plates with spring hinged waterproof caps suitably configured for each application, with faceplate gaskets and corrosion-resistant fasteners.

## **2.3 JUNCTION AND PULL BOXES**

- A. Building Structure Type: Code-gage sheet steel with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with galvanized steel bolts, nuts and accessories.
- B. Buried Type: Plastic body and cover, or pre-cast concrete with screw-on traffic rated cast iron covers; of types, shapes and sizes to suit each respective location and installation; equipped with stainless steel bolts, nuts and accessories.

# **PART 3 EXECUTION**

## **3.1 PREPARATION**

- A. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
- B. Provide knockout closures to cap unused knockout holes where blanks have been removed.

## **3.2 INSTALLATION**

- A. A. Install where indicated, complying with manufacturer's written instruction, applicable requirements of NFPA 70 and NEMA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Install coverplates for all boxes; weatherproof outlets for interior and exterior locations exposed to weather or moisture.
- C. Install boxes and fittings to ensure ready accessibility of electrical wiring. Install recessed boxes with face of box or ring flush with adjacent surface.
- D. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10-inches of conduit between them.

- END OF SECTION -



**SECTION 26 05 73**  
**SHORT-CIRCUIT/COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS**

**PART 1 GENERAL**

**1.1 SCOPE**

- A. The contractor shall furnish short-circuit and protective device coordination studies which shall be prepared by the equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.5 and Informative Annex D. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 - 2002, the IEEE Guide for Performing Arc-Flash Calculations.
- C. Related work includes but is not limited to:
  - 1. Section 26 05 05 - Electrical Equipment
  - 2. Section 26 05 13 - Conductors and Cables
  - 3. Section 26 29 26 - Panelboard
  - 4. Section 26 24 19 - Motor Control Center
  - 5. Section 26 29 13.16 - Reduced Voltage Soft Starters
  - 6. Section 26 29 33 - Variable Frequency Drive

**1.2 REFERENCES**

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
  - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
  - 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
  - 4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
  - 5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
  - 6. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
  - 1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
  - 2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
  - 3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis

4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories
  5. ANSI C37.5 – Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal-Frequency Recovery Voltage, and for Simplified Calculation of Fault Currents
- C. The National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code, latest edition
  2. NFPA 70E – Standard for Electrical Safety in the Workplace

### **1.3 SUBMITTALS FOR REVIEW/APPROVAL**

- A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

### **1.4 SUBMITTALS FOR CONSTRUCTION**

- A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (2) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies shall be provided on CD in PDF format.
- B. The report shall include the following sections:
1. Executive Summary including source of information and assumptions made.
  2. Descriptions, purpose, basis and scope of the study.
  3. One-line diagram showing protective device ampere ratings and associated designations, cable size & lengths, transformer kVA & voltage ratings, motor & generator kVA ratings, and switchgear/switchboard/panelboard designations.
  4. Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches, circuit breakers, fuses, etc.); the short circuit duties shall be upward-adjusted for X/R ratios that are above the device design ratings.
  5. Protective device time versus current coordination curves with associated one line diagram identifying the plotted devices, tabulations of ANSI protective relay functions and adjustable circuit breaker trip unit settings.
  6. Multi-function relay setting file printouts including all ANSI protective relay functions and associated logic and control. Metering, communication, and control logic settings not associated with ANSI protective functions are not required.
  7. Fault study input data, case descriptions, and current calculations including a definition of terms and guide for interpretation of the computer printout.
  8. Incident energy and flash protection boundary calculations.
  9. Comments and recommendations for system improvements, where needed.

## **1.5 QUALIFICATIONS**

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer shall be a full-time employee of the Engineering Services Organization.

## **PART 2 PRODUCT**

### **2.1 STUDIES**

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer. By using the equipment manufacturer the study allows coordination of proper breakers, fuses, and current transformers. The coordination study shall begin with the utility company's feeder protective device and include all of the electrical protective devices down to and include the largest feeder circuit breaker and motor starter in the 480 Volt motor control centers and power distribution panelboards. The study shall also include variable frequency drives, harmonic filters, power factor correction equipment, transformers and protective devices associated with variable frequency drives, emergency and standby generators associated paralleling equipment and distribution switchgear.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.5 and Informative Annex D.

### **2.2 DATA COLLECTION**

- A. Contractor shall furnish all field data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future utility supplies, motors, and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.
- D. Include fault contribution of existing motors in the study, with motors < 50 HP grouped together. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

## **2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY**

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standards 141, latest edition.
- B. Transformer design impedances and standard X/R ratios shall be used when test values are not available.
- C. Provide the following:
  - 1. Calculation methods and assumptions
  - 2. Selected base per unit quantities
  - 3. One-line diagram of the system being evaluated with available fault at each bus, and interrupting rating of devices noted
  - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
  - 5. Typical calculations
  - 6. Tabulations of calculated quantities
  - 7. Results, conclusions, and recommendations
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
  - 1. Electric utility's supply termination point
  - 2. Incoming switchgear
  - 3. Unit substation primary and secondary terminals
  - 4. Low voltage switchgear
  - 5. Motor control centers
  - 6. Standby generators and automatic transfer switches
  - 7. Branch circuit panelboards
  - 8. Other significant locations throughout the system
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
  - 1. Evaluate equipment and protective devices and compare to short circuit ratings
  - 2. Adequacy of switchgear, motor control centers, and panelboard bus bracing to withstand short-circuit stresses
  - 3. Adequacy of transformer windings to withstand short-circuit stresses
  - 4. Cable and busway sizes for ability to withstand short-circuit heating
  - 5. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current

## **2.4 PROTECTIVE DEVICE COORDINATION STUDY**

- A. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

- B. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
- D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the curve sheets, where applicable:
  - 1. Electric utility's protective device.
  - 2. Medium voltage equipment relays
  - 3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
  - 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  - 5. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters
  - 6. Medium voltage conductor damage curves
  - 7. Ground fault protective devices, as applicable
  - 8. Pertinent motor starting characteristics and motor damage points
  - 9. Pertinent generator short-circuit decrement curve and generator damage point
  - 10. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.
- G. Select each primary protective device required for a delta-wye connected transformer so that the characteristics or operating band is within the transformer parameters which includes a parameter equivalent to 58% of the ANSI withstand point to afford protection for secondary line-to-ground faults.
- H. Separate low voltage power circuit breakers from each other and the associated primary protective device by a 16% current margin for coordination and protection in the event of secondary line-to-line faults.
- I. Engineer shall provide settings file printouts for all multifunction relays supplied under this contract including all ANSI protective relay functions and associated logic and control. Metering, communication, and control logic settings not associated with ANSI protective functions are not required.

## **2.5 ARC FLASH HAZARD ANALYSIS**

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2012, Informative Annex D.
- B. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study

model. Alternative methods shall be presented in the proposal.

- C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- D. The Arc-Flash Hazard Analysis shall include all MV, 575v, & 480v locations and significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.
- E. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- F. The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
- G. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- H. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

- I. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
- J. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on busses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond 5 cycles.
  - 2. For each piece of ANSI rated equipment with an enclosed main device, two

calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

- K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- L. Arc-Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## **2.6 REPORT SECTIONS**

### **A. Input Data:**

- 1. Utility three-phase and line-to-ground available contribution with associated X/R ratios
- 2. Short-circuit reactance of rotating machines with associated X/R ratios
- 3. Cable type, construction, size, # per phase, length, impedance and conduit type
- 4. Bus duct type, size, length, and impedance
- 5. Transformer primary & secondary voltages, winding configurations, kVA rating, impedance, and X/R ratio
- 6. Reactor inductance and continuous ampere rating
- 7. Aerial line type, construction, conductor spacing, size, # per phase, and length

### **B. Short-Circuit Data:**

- 1. Source fault impedance and generator contributions
- 2. X to R ratios
- 3. Asymmetry factors
- 4. Motor contributions
- 5. Short circuit kVA
- 6. Symmetrical and asymmetrical fault currents

### **C. Recommended Protective Device Settings:**

- 1. Phase and Ground Relays:
  - a. Current transformer ratio.
  - b. Current setting.
  - c. Time setting.
  - d. Instantaneous setting.
  - e. Specialty non-overcurrent device settings.

- f. Recommendations on improved relaying systems, if applicable.
  - 2. Circuit Breakers:
    - a. Adjustable pickups and time delays (long time, short time, ground).
    - b. Adjustable time-current characteristic.
    - c. Adjustable instantaneous pickup.
    - d. Recommendations on improved trip systems, if applicable.
- D. Incident energy and arc flash boundary calculations.
  - 1. Arcing fault magnitude
  - 2. Device clearing time
  - 3. Duration of arc
  - 4. Arc flash boundary
  - 5. Working distance
  - 6. Incident energy
  - 7. Recommendations for arc flash energy reduction

## **PART 3 EXECUTION**

### **3.1 FIELD ADJUSTMENT**

- A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify Owner in writing of any required major equipment modifications.
- D. Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

### **3.2 ARC FLASH WARNING LABELS**

- A. The vendor shall provide a 4 in. x 4 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The label shall have an orange header with the wording, "WARNING, SHOCK & ARC FLASH HAZARD", and shall include the following information:
  - 1. Location designation
  - 2. Nominal voltage
  - 3. Arc flash boundary
  - 4. Personnel Protective Equipment category
  - 5. Incident energy (cal/cm<sup>2</sup>)
  - 6. Working distance



7. Shock Boundaries
  8. Engineering report number, revision number and issue date
- C. Labels shall be machine printed, with no field markings
- D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
1. For each 600, 480 and applicable 208 volt panelboards and disconnects, one arc flash label shall be provided
  2. For each motor control center, one arc flash label shall be provided
  3. For each low voltage switchboard, one arc flash label shall be provided
  4. For each switchgear, one flash label shall be provided
  5. For medium voltage switches one arc flash label shall be provided
- E. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

### **3.3 ARC FLASH TRAINING**

- A. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard For Electrical Safety Requirements For Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

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**SECTION 26 09 26**  
**PANELBOARD**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Electrical distribution panelboards.
- B. Connections between fixtures, equipment and panelboards.

**1.2 REFERENCES**

- A. NEMA 1: Instructions for Safe Installation. Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- B. NEMA 250: Enclosures for Electrical Equipment (1000 Volt Maximum).
- C. NFPA 70: National Electrical Code.
- D. UL: Underwriters' Laboratories Inc.

**1.3 SUBMITTALS**

- A. Product Data: Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.
- B. Shop Drawings. Submit showing accurately scaled layouts of enclosures and required individual panelboard devices. Show circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

**1.4 QUALITY ASSURANCE**

- A. Construct panelboards to NEMA 1 and NEMA 250 Standards and provide UL labels.
- B. Comply with NFPA 70 pertaining to installation of wiring and equipment in hazardous locations.
- C. Make all grounding tight and secure throughout.

**PART 2 PRODUCTS**

**2.1 PANELBOARD - GENERAL**

- A. Provide panel boards of the same make and key alike with a master key arrangement.
- B. Use dead front panelboards with one-piece cabinets constructed from code gage

steel. Cabinets shall have knockouts and minimum gutter space of 4- inches on all sides.

C. Interiors:

1. Utilize panelboard interiors that are factory assembled complete with circuit breakers as indicated. Furnish circuit breakers in positions where diagram or schedule indicates SPARE. Furnish only complete provisions for future circuit breakers where diagram indicates SPACE, and cover the resulting opening in the cabinet front with an easily removable metal cover. Utilize panelboards with interiors designed so that circuit breakers can be replaced without removing the main bus.
2. Provide bus bars of copper and full sized throughout their length. Make complete provisions for mounting future circuit breakers throughout the full length of the bus provided regardless of the number of units and spaces called for. Provide all machining, drilling, or tapping required to add or change circuit breakers in the future. Bolt together and rigidly support bus bars and connection straps on molded insulators.
3. Furnish an insulated neutral bus bar rated the same as the phase bus bars and having at least one terminal screw for each branch circuit. Furnish a copper ground bus bar installed on the panelboard frame, bonded to the box, and containing at least one terminal screw for each circuit. Provide solderless main lugs for main, neutral, and ground bus bars. Provide lugs and connection point on phase, neutral, and ground busses suitable for either copper or aluminum conductors.

D. CIRCUIT BREAKERS

1. Furnish indicating type molded circuit breakers providing ON/OFF and TRIPPED positions of the operating handle. Furnish thermal magnetic, quick-make, quick-break circuit breakers which are noninterchangeable in accordance with the NEC. Do not use tandem or dual circuit breakers in normal single-pole spaces. Do not use single-pole circuit breakers with handle ties where multiple circuit breakers are indicated. Utilize multipole circuit breakers designed so that on overload on one pole automatically causes all poles to open. Provide circuit breakers meeting requirements of NEMA AB 1. Install bolt-on circuit breakers in all panelboards.

- E. Use factory assembled panelboards with amp rating units indicated. Provide spare units and blank spaces as indicated. Main circuit breaker or lugs only as indicated.
- F. Affix large, permanent individual numbers to each breaker on panel board face in a uniform position. Number starting at the top, with odd numbers used in sequence down left hand side and even numbers used in sequence down right hand side.
- G. Use fronts manufactured with code gage steel, finished with rust inhibiting primer and baked enamel finish and manufacturer's standard color. Provide doors with

flush tumbler type locks. Provide a circuit directory frame and card with a clear plastic covering inside the door.

- H. Furnish locking clips for "off" position only, with "on" trip free travel and installed in all circuits so indicated.
- I. Label panel with black phenolic or acceptable alternate engraved nameplate with 1/4 inch high lettering on the interior of each panelboard; including panel name and voltage. Provide red nameplate on emergency system panels.
- J. For outside locations use a NEMA 3R cabinet.

## **2.2 PANELBOARD - 480 VOLT**

- A. Voltage: 480Y/277 volts, 3 phase, 4 wire, S/N, equipped with automatic circuit breaker.
- B. Circuit Breakers: Minimum interrupting capacity of 14,000 amps at 277 volts, or as shown on the drawings. Use breakers that are UL rated for use as switches.
- C. Locking Clips: 5 minimum per panel.

## **2.3 PANELBOARD - 240 VOLT**

- A. Voltage: 240/120 volts, 1 phase, 3 wire, S/N, equipped with automatic circuit breakers.
- B. Circuit Breakers: Minimum interrupting capacity of 10,000 amps at 120 volts, or as shown on the drawings.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- A. Provide mounting brackets, bus bar drillings and filler pieces for unused spaces.
- B. Prepare and affix typewritten directory to inside cover of panelboard indicating loads controlled by each circuit.
- C. Install per NFPA 70, NEMA. manufacturer's instructions and authorities having jurisdiction.

- END OF SECTION -

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**SECTION 26 21 16**  
**LOW-VOLTAGE UNDERGROUND ELECTRICAL SERVICE ENTRANCE**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes arrangement with Utility Company for permanent electric service; payment of Utility Company charges for service; service provisions; and utility metering equipment.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete: Concrete pads.

**1.2 REFERENCES**

- A. National Electrical Contractors Association
  - 1. NECA Standard of Installation.
- B. American National Standards Institute
  - 1. NFPA 70 - National Electrical Code.
  - 2. NFPA 72 - National Electrical Safety Code.
- C. National Electrical Manufacturers Association
  - 1. Pub/No. AB 1: Molded Case Circuit Breakers
  - 2. Stds Pub/No. AB 3: Molded Case Circuit Breakers and Their Application.
  - 3. Stds Pub/No. KS 1: Enclosed Switches
  - 4. Stds Pub/No. PB 2: Deadfront Distribution Switchboards.
  - 5. Stds Pub/No. PB 2.2: Application Guide for Ground fault Protective Devices for Equipment.
  - 6. Stds Pub/No. SG 3: Low-Voltage Power Circuit Breakers.
  - 7. Stds Pub/No. SG 4: Alternating-Current High-Voltage Circuit Breakers.
  - 8. Stds Pub/No. SG 5: Power Switchgear Assemblies.

**1.3 SYSTEM DESCRIPTION**

- A. Utility Company: Rocky Mountain Power
- B. System Characteristics: 2400 Amps 480Y/277 volts, three phase, four wire, 60 Hertz.
- C. Service Entrance: Underground.
- D. Underground Service Provisions:
  - 1. Utility Raceway Connection: Utility Company's terminal pole.

2. Utility Service-Entrance Conductor Connection: Utility Company's pad-vault mounted transformer.

#### **1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal procedures.
- B. Submit Utility Company prepared drawings.

#### **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with Utility Company written requirements.
- B. Maintain one copy of each document on site.

#### **1.6 FIELD MEASUREMENTS**

- A. Verify field measurements are as indicated on Drawings. Coordinate with Power Company for final location of equipment.

#### **1.7 COORDINATION**

- A. Coordinate with utility company, relocation of overhead or underground lines interfering with construction. Where power lines are to be relocated, include costs in this contract.
- B. Contact utility company regarding charges related to service installation. Include utility charges in this contract.
- C. Utility charges for service installation will be paid by Owner and are not part of this contract.

### **PART 2 PRODUCTS**

#### **2.1 UTILITY METER**

- A. Furnished by Utility Company.

#### **2.2 UTILITY METER BASE**

- A. Manufacturers:
  1. **Circle AW.**
  2. **Milbank.**
  3. **Square D Company.**
  4. Approved equal.
- B. Product Description: Meter base ring type, EUSERC approved, with a space for utility provided test switch. Meter base shall comply with Rocky Mountain Power regulations.



## **2.3 CURRENT TRANSFORMER CABINET**

### **A. Manufacturers:**

1. **Square D.**
2. Same manufacturer as service entrance switchgear.
3. Approved equal.

### **B. Size: 36 inches wide x 48 inches high x 11 inches deep. If Line and Load enter on the bottom a larger enclosure will be required. Comply with Rocky Mountain Power regulations.**

### **C. Include provisions for padlocking and sealing.**

## **2.4 TRANSFORMER PAD/VAULT**

### **A. Cast-in-Place Concrete as shown on the drawings.**

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify service equipment is ready to be connected and energized.

### **3.2 INSTALLATION**

- A. Install service entrance conduits to building service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors
- B. Install concrete pad/vault for transformer, in accordance with Rocky Mountain Power regulations.

- END OF SECTION -

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**SECTION 26 29 23**  
**VARIABLE FREQUENCY DRIVES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes enclosed variable frequency controllers.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections:

1. Section 01 33 00 Submittal Procedures
2. Section 01 75 50 Project Closeout
3. Section 26 06 05 Electrical Equipment
4. Section 26 05 13 Conductors and Cables

**1.3 REFERENCES**

- A. IEEE C62.41 (Institute of Electrical and Electronics ENGINEER's) - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. NEMA FU 1 (National Electrical Manufacturers Association) - Fuses.
- C. NEMA ICS 3.1 (National Electrical Manufacturers Association) - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.
- D. NEMA ICS 7 (National Electrical Manufacturers Association ) - Industrial Control and Systems:
1. Speed Drives.
- E. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. NETA ATS (International Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

**1.4 SUBMITTALS**

- A. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- B. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings dimensions, and enclosure details.

- C. Test Reports: Indicate field test and inspection procedures and test results.
- D. Manufacturers Field Reports: Indicate start-up inspection findings.
- E. Five copies, plus the number of copies the CONTRACTOR wishes returned, shall be submitted to the ENGINEER for approval.
- F. Manufacturer's warranty.

## **1.5 SUBMITTED AT SHIPMENT**

- A. Include system manuals, complete with wiring diagrams, schematics, operating, and maintenance instructions, shall be provided with the VFD and VFD systems at the time of shipment, on both hard and digital copies.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Section 01 78 50 - Project Closeout.
- B. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 3.1. Include procedures for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions. Include routing preventive maintenance schedule.

## **1.7 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience and service facilities within 100 miles of the project.

## **1.8 STANDARDS**

- A. The VFD shall be UL listed and not require external fuses except where input power is supplied from multiple transformer secondaries.
- B. All VFD and VFD systems shall be designed in accordance with applicable portions of NEMA standards, and panel build ups manufactured by a UL508 listed manufacturer.
- C. The VFD shall be compatible with the installation requirements of interpretive codes such as National Electric Code (NEC) and Occupational Safety & Health Act (OSHA).
- D. The VFD shall be capable of operating in compliance with IEEE 519-1992.
- E. The VFD shall meet IEC 612 00-2 for vibration levels.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

## **1.10 ENVIRONMENTAL REQUIREMENTS**

- A. Section 26 05 00 - Electrical General Requirements.
- B. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

## **1.11 WARRANTY**

- A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship for 1 year from date of Final Acceptance of the system and shall include labor and travel time for necessary repairs at the job site.
- B. The manufacturer shall provide the service of a factory-trained service representative to verify the correctness of the CONTRACTOR's completed installation; to check all electronic circuitry and mechanical components to assure their proper function; and to make all necessary measurements in and around the unit to ensure proper operation. A minimum of 1-day startup service shall be provided. The manufacturer shall provide through the CONTRACTOR to OWNER a written certification that the installation is complete, correct and properly calibrated.

## **1.12 MAINTENANCE SERVICE**

- A. Provide service and maintenance of variable frequency controller for one year from Date of Final Acceptance.

## **1.13 MAINTENANCE MATERIALS**

- A. Supply two of each air filter.
- B. Provide three of each fuse size and type.

# **PART 2 PRODUCTS**

## **2.1 VARIABLE FREQUENCY CONTROLLER**

- A. Manufacturers:
  - 1. **Square D, Altivar Process 630 Drive**
  - 2. Or Owner Approved Equals
- B. Product Description: NEMA ICS 7, enclosed 6 pulse variable frequency controller suitable for operating the indicated loads. Select unspecified features and options in accordance with NEMA ICS 3.1. Motor controller shall include a VFD matrix harmonic filter, bypass motor contactor and power factor correction contactor and capacitors as shown on the drawings.

## **2.2 RATINGS**

- A. Rated Input Voltage: 480 Volts, three phase, 60 Hertz. The VFD shall be able to withstand voltage variations of -15% to +10% without tripping or affecting VFD performance.
- B. Bypass contactor shall be rated for 115% of the motor full load current. It is not intended to be a full-voltage, non-reversing motor controller contactor. The contactor shall be mechanically interlocked to de-energize the VFD output when the motor is running on the bypass contactor. Control of the bypass contactor shall be determined by the Main Control Panel.
- C. Motor Nameplate Voltage: 460 Volts, three phase 60 Hertz.
- D. Motor Nameplate Horsepower: 100 horsepower design B.
- E. Displacement Power Factor: Between 1.0 and 0.95 lagging over entire range of operating speed and load.
- F. Operating Ambient: 0 degrees C to 50 degrees C.
- G. Relative Humidity: 5 to 95 percent non-condensing.
- H. Minimum Efficiency at Full Load: 96 percent.
- I. Elevation: The VFD shall be suitable for operations up to 4,500 feet.

## **2.3 DESIGN FEATURES**

- A. Employ microprocessor-based inverter logic isolated from power circuits.
- B. Employ pulse-width-modulated inverter system.
- C. Design for ability to operate controller with motor disconnected from output.
- D. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.
- E. The VFD shall be capable of 4 different acceleration and different deceleration rates, each rate independently adjustable from 0.01 to 3600 seconds. Selectable accel/decel patterns to include linear, S-curve, and non-linear for variable torque loads.
- F. The VFD shall have the capability of determining motor characteristics to optimize its operation with the use of pre-programmed motor data information or self-tuning operation. Self-tuning is to be available with or without the motor coupled to the load. Tuning shall also include an online mode that automatically and dynamically compensates the VFD regulator for changes in motor temperature.

## **2.4 INDICATORS AND MANUAL CONTROLS**

- A. Input Signal: 4 - 20 mA DC.
- B. Display:
  - 1. Provide integral LCD display to indicate output voltage, output frequency, output current, fault codes and drive status.
  - 2. Upon a fault condition, the LCD shall display VFD output current, voltage, frequency, torque, DC link voltage, operating hours, I/O terminal status, and temperature at the time of fault. The last four (4) faults will be stored in memory and selectively be displayed on the LCD.
- C. Indicator Lights:
  - 1. VFD Failure.
  - 2. VFD ON status light
  - 3. VFD OFF status light
  - 4. Bypass contactor ON status light
  - 5. Bypass contactor OFF status light
- D. Selector Switches:
  - 1. HAND-OFF-REMOTE selector switch.
- E. Manual speed potentiometer (0-100%).
- F. The drive shall have a built-in keypad that is installed on the outside cover and shall include Forward/Reverse/Stop/Jog keys, Drive reset key and Reference increment/decrement keys.
- G. Volts Per Hertz Adjustment: Plus or minus 10 percent.
- H. Current Limit Adjustment: 60 - 110 percent of rated.
- I. Acceleration Rate Adjustment: 0.5 - 30 seconds.
- J. Deceleration Rate Adjustment: 1 - 30 seconds.
- K. Control Power Source: Integral control transformer.

## **2.5 SAFETIES AND INTERLOCKS**

- A. Includes undervoltage release.
- B. Door Interlocks: Mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.
- C. Safety Interlocks: Terminals for remote contact to inhibit starting under both manual and automatic mode.
- D. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic

mode.

- E. The VFD shall be able to automatically reset up to ten (10) times after over-current, over-voltage, overheating, and overload faults. Reset attempts and reset intervals must be programmable.
- F. Disconnecting Means: Integral circuit breaker on the line side of each controller.

## **2.6 VFD INPUT/OUTPUT PARAMETERS**

- A. The VFD shall accept and follow a selectable external frequency reference of either analog 0-5 VDC, 0-10 VDC, 4-20m A with signal inversion.
- B. The VFD shall maintain the output frequency to within 0.2% of reference when the reference is analog, and to within .01% of reference when the reference is digital (Speed level inputs from keypad, contact closure, digital interface, or serial communication).
- C. The VFD shall have a reference filter to reduce noise in the analog signals and a low noise control power supply system.
- D. The VFD shall accept inputs from external dry contacts for the following functions:
  - 1. Run forward command
  - 2. Run reverse command
  - 3. Multi-step frequency selection
  - 4. Acceleration/Deceleration time selection
  - 5. Stop command
  - 6. Coast to stop command
  - 7. Alarm reset
  - 8. Trip command (external fault)
  - 9. Jogging operation
  - 10. Frequency reference selection (2)
  - 11. DC brake command
  - 12. Torque limits (2)
  - 13. Switching operation between line and inverter (50 and 60 Hz)
  - 14. Speed Increase command
  - 15. Speed Decrease command
  - 16. Write enable for keypad
  - 17. PID control cancel
  - 18. Inverse mode changeover
  - 19. Interlock signal
  - 20. Serial communications enable
  - 21. Universal DI
  - 22. Pick up start mode
  - 23. Forced stop command
  - 24. Forced stop command with Deceleration time
- E. The frequency reference shall be from, selectively, an external speed potentiometer, external analog signals (0-5 VDC, 0-10 VDC, 4 to 20mA with signal inversion), from the built in keypad, or from serial communication.



1. The VFD shall provide five selectable digital outputs indicating the following:
  - a. Inverter running
  - b. Frequency equivalence signal
  - c. Frequency level detection
  - d. Torque polarity
  - e. Torque limiting
  - f. Auto-restarting
  - g. Overload early warning
  - h. Keypad operation mode
  - i. Inverter stopping
  - j. Ready input
  - k. Line/Inverter changeover
  - l. Motor 2 / Motor 1
  - m. Auxiliary terminal
  - n. Time-up signal
  - o. Cycle completion time
  - p. Stage No Indication (1, 2, and 4)
  - q. Alarm Indication (1, 2, 4, and 8)
  - r. Fan operation signal
  - s. Auto resetting
  - t. Universal DO
  - u. Overheat early warning
  - v. Second frequency level detection
  - w. Second overload early warning
  - x. Terminal C1 off signal

## **2.7 PROTECTIVE AND DIAGNOSTIC FEATURES**

- A. When a fault occurs, the VFD shall have a controlled shut down sequence. A Form C relay fault output shall be available. The reason for the fault condition shall be enunciated on the LED display, and the LCD graphic screen shall display the current, temperature, frequency, and voltage at the time of the fault as well as potential reasons for the condition. The VFD shall monitor, sense, and display the following fault conditions:

1. Over-current during acceleration
2. Over-current during deceleration
3. Over-current during constant speed operation
4. Ground fault
5. Input phase loss
6. Fuse blown
7. Over-voltage during acceleration
8. Over-voltage during deceleration
9. Over-voltage during constant speed operation
10. Under-voltage
11. Overheating of heatsink
12. External thermal relay
13. Over-temperature of internal air
14. Overheating at Dynamic Braking circuit
15. Motor 1 overload

16. Motor 2 overload
  17. Inverter unit overload
  18. Over-speed
  19. Memory Error
  20. Keypad panel communication error
  21. CPU error
  22. Option error
  23. Operational procedure error
  24. Output wiring error / Impedance imbalance
  25. Modbus-RTU error
- B. The VFD shall have a selectable Torque Limiting function for both motoring and braking that will sense an overload condition and will reduce frequency and current temporarily until the load reaches acceptable levels. If the overload condition is not settled in the proper amount of time, the Drive will trip on overload. The Torque Limiting shall be programmable from 20-150% of Drive rated motor torque (30 HP and below) and from 20-150% of Drive rated motor torque (40 HP and above), with 1% resolution.
- C. The VFD shall have a selectable electronic inverse time thermal overload function as required by NEC and UL Standard 991 for an AC Induction Motor (Refer to applicable codes for specific installation requirements). The overload shall be programmable from 20 - 135% of Drive rated current.
- D. The VFD shall have an over-voltage protection function that operates if supply voltage rises above rated value or by motor's regeneration.
- E. The VFD shall treat short circuits in either the output load or the output module as an over-current.
- F. If the VFD heat sink temperature exceeds approximately 100-degrees C, the Drive will shut down on over temperature fault.
- G. The VFD shall provide output ground fault protection.
- H. The VFD shall provide LED indication of DC bus voltage, which, when lit, will signify to maintenance people the presence of potentially dangerous voltage.

## **2.8 VFD CONSTRUCTION**

- A. The VFD shall be a sinusoidal PWM type Drive with sensor-less vector control capability. The VFD Supplier shall provide open chassis, IP20, NEMA 1 enclosures at all ratings as required for the application. Drive shall be of modular construction for ease of access to control and power wiring, and maintenance. It shall consist of the following general components:
1. Full wave diode AC/DC rectifier, to eliminate line voltage notching of the three phase source and maintain an input displacement power factor of 0.95 or greater, regardless of speed or load. SCR front ends with gate firing electronics are unacceptable.
  2. DC link capacitors standard, DC link reactor available at all ratings, standard on

- systems 100HP+.
3. Input surge protection performed by internal MOV'S (metal oxide varistors) or devices providing equal protection.
  4. Insulated Gate Bipolar Transistor (IGBT) power section. The power section control shall use vector dispersal pulse width modulated (PWM) control and fourth generation soft switching IGBTs to reduce noise and allow longer cable length from VFD to motor without the need for output filters.
  5. The VFD shall be microprocessor based and fully transistorized with a 32 bit MCU and 33 MIPS processing speed.
  6. Separate control and power terminal boards, with option plug shall be provided by the VFD to allow for remote operation.
  7. The VFD shall have an RS485 serial communications port as a standard with options for communicating with recognized industry standard device level networks such as Ethernet, Modbus Plus. A universal ethernet adapter shall be provided as an interface with the serial communications port.
  8. The VFD shall have a Keypad capable of copying, uploading and downloading Drive function codes.

## **2.9 INPUT FILTER**

- A. Harmonic Filter: Provide a Matrix Harmonic Filter to reduce the harmonic currents going back into the utility power grid and power system. The total harmonic voltage distortion factor (DF) at the main 480 volt bus for voltage shall be less than 5 percent.
- B. The filter shall include a contactor that shall de-energize the capacitors when the drive is less than 30% output.

## **2.10 PROCESS ALARM SWITCH**

- A. Manufacturer/Model:
  1. CR Magnetix/CR3595.
  2. Or approved equal.
- B. Description - Provide a process alarm switch to monitor the VFD output Hz. When the control loop exceeds the set point the relay becomes energized and the on-board LED illuminates.
- C. Input Power: 24 VDC.
- D. Output: Form C Relay, 10A at 125 VAC.
- E. Process variable: 4-20 mA DC
- F. DIN Rail mounting.

## **2.11 VOLTAGE MONITOR/SAFE-TEST POINT**

- A. Manufacturer/Model:
  1. Grace Technologies/R-3W2MT-LMH

2. No Equal.
- B. Operational Voltage: 40-600 VAC, 60 Hz.
- C. Storage Temperature: -45-deg C to +85-deg C.
- D. Operating Temperature: -20-deg C to +55-deg C.
- E. Unit shall be installed in a 30 mm pushbutton hole.
- F. UL Type: 12 & 13.

## **2.12 POWER FACTOR CORRECTION CAPACITORS**

- A. When running on the bypass contactor, the VFD enclosure shall include a FVNR contactor and timing relays to automatically energize the power factor correction capacitors.

## **2.13 SURGE PROTECTIVE DEVICE**

- A. TVSS Manufacturer:
  1. **Eaton**
  2. **Raycap**
  3. **Square D**
  4. Or Approved equal.
- B. This Section describes the materials and installation requirements for an integrated Transient Voltage Surge Suppressor (TVSS), also referred to as Surge Protective Device (SPD), inside VFD enclosure. These devices are used to protect AC electrical circuits from the effect of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and or capacitive load switching.
- C. References
  1. UL 1449 Second Edition 2005 - Transient Voltage Surge Suppressors
  2. UL 1283 - Electromagnetic Interference Filters
  3. ANSI/IEEE C62.41.1-2002 - IEEE Guide on the Surge Environment in Low Voltage (1000 V and Less) AC Power Circuits; C62.41.2-2002 - IEEE Recommended Practice on Characterization of Surge Voltages in Low Voltage AC Power Circuits; and C62.45-2002 - IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
  4. NEC 2017 Article 285
- D. Internal TVSS
  1. TVSS shall be Listed in accordance with UL 1449 Second Edition 2005 and UL 1283, Electromagnetic Interference Filters.
  2. Integrated surge protective devices (SPD) shall be Component Recognized in accordance with UL 1449 Second Edition, Revision 2/9/2005 Section 37.3 and 37.4 at the standard's highest short-circuit current rating (SCCR) of 200 kA,

including intermediate level of fault current testing that will be effective 2/9/2007.

3. TVSS shall be tested with the ANSI/IE EE Category C High exposure waveform (20kV -1.2/50s, 10kA-8/20s).
4. TVSS shall provide suppression for all modes of protection: L-N, L-G, and N-G in WYE systems.
5. Recommended TVSS ratings:
  - a. Minimum surge current rating shall be 90 kA per phase (80 kA per mode) for service entrance and 80 kA per phase (40 kA per mode) for distribution applications.
  - b. UL 1449 clamping voltage must not exceed the following: 480Y/277
  - c. Pulse life test: Capable of protecting against and surviving 5000 ANSI/IE EE Category C High transients without failure or degradation of clamping voltage by more than 10%.
6. TVSS shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
7. TVSS shall be constructed of one self-contained suppression module per phase.
8. Visible indication of proper TVSS connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable. The status of each TVSS module shall be monitored on the front cover of the enclosure as well as on the module. A push-to-test button shall be provided to test each phase indicator. Push-to-test button shall activate a state change of dry contacts for testing purposes.
9. TVSS shall be equipped with an audible alarm which shall activate when any one of the surge current modules has reached an end-of-life condition. An alarm on/off switch shall be provided to silence the alarm. The switches and alarm shall be located on the front cover of the enclosure.
10. A connector shall be provided along with dry contacts (normally open or normally closed) to allow connection to a remote monitor or other system. The output of the dry contacts shall indicate an end-of-life condition for the complete TVSS or module.
11. Terminals shall be provided for necessary power and ground connections.
12. The TVSS shall be equipped the following optional items:
  - a. A transient voltage surge counter shall be located on the diagnostic panel on the front cover of the enclosure. The counter shall be equipped with a manual reset and battery backup to retain memory upon loss of AC power.

- E. TVSS shall have a warranty for a period of ten (10) years from date of Final Acceptance. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by the respective field service division.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that building environment can be maintained within the service conditions required by the manufacturer.

### **3.2 INSTALLATION**

- A. Install in accordance with NEMA ICS 3.1.
- B. Tighten accessible connections and mechanical fasteners after placing controller.
- C. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- D. Provide engraved plastic nameplates under the provisions of Section 26 05 00.
- E. Motor Data: Neatly type label inside controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.
- F. Ground and bond controller under the provisions of Section 26 05 26.

### **3.3 QUALITY ASSURANCE**

- A. All VFD's shall be 100 % factory tested to ensure proper performance upon delivery.
- B. VFD's installed in panels shall be 100% factory tested as a system by the VFD supplier.

### **3.4 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 3.1.

### **3.5 MANUFACTURER'S FIELD SERVICES**

- A. Prepare and startup variable frequency controller.
- B. VFD operational and maintenance training and startup service shall be provided by the VFD supplier. The VFD vendor shall have factory trained personnel at field locations convenient to the installation site, available for trouble shooting and/or startup assistance 24/7.
- C. Coordinate factory startup with the VFD, motor and Motor Protector factory representatives.
- D. Coordinate VFD settings and the Backup Power Generator so that the facility operates as intended on both utility power and on backup generator power.

### **3.6 DEMONSTRATION AND TRAINING**

- A. Provide 4 hours of instruction each for 6 persons, to be conducted at Project Site with manufacturer's representative.

### **3.7 WARRANTY**

- A. The VFD vendor shall provide a warranty for material and workmanship, for a period of twenty-four months after start-up.
- B. Warranty and non-warranty service shall be available in house and in the field. There shall be authorized service centers locally available within 4 hours.

### **3.8 SPARE PARTS**

- A. Provide a list of all spare parts to the OWNER at Substantial Completion.

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**SECTION 26 32 13.13**  
**DIESEL-ENGINE GENERATOR SETS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Provide a modular power system (MPS) to supply electrical power at 480Y/277 VAC, 3-phase in the event of the failure of normal utility supply. Equipment shall consist of (1) 400 kW Standby generator now, with a 2<sup>nd</sup> 400 kW for the Phase 1 expansion and another 3<sup>rd</sup> 400 kW for the final pump station configuration.
- B. The generator shall consist of a liquid cooled engine, with AC alternator and system controls with all necessary accessories for a complete operating system, included but not limited to the items as specified hereinafter.
  - 1. The backup power system shall include a System Controller that provides load management capability and single point of communications and control, and has the capability of adding the 2<sup>nd</sup> and 3<sup>rd</sup> generator in the future.
- C. Provide an automatic transfer switch (ATS) so the system comes on-line fully automatically, and on restoration of utility power, automatically retransfers load to normal power, shuts down the generator and returns to readiness for another operating cycle. The ATS shall be installed in the service equipment lineup as shown on the drawings.
  - 1. Provide the ATS in the service equipment lineup. As option, the ATS will be installed in a separate pad-mounted NEMA 3R enclosure installed adjacent to the site Service Equipment and Main Service Disconnect.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Engine-generator set.
  - 2. Provide engine generator set including but not necessarily limited to the following:
    - a. Engine.
    - b. Cooling system.
    - c. Exhaust system.
    - d. Mounting.
    - e. Starting system.
    - f. Generator.
    - g. Control equipment and accessories.
    - h. Housing.
    - i. Output circuit breaker.
- B. Related Sections include but are not necessarily limited to:

1. Division 1 - General Requirements.
2. Division 26 - Electrical.

### 1.3 QUALITY ASSURANCE

#### A. Referenced Standards:

1. National Electrical Manufacturer's Association (NEMA).
2. National Fire Protection Association (NFPA):
  - a. 70, National Electrical Code (NEC).
  - b. 110, Underwriter's Laboratories, Inc. (UL).

#### B. Testing:

1. Prototype Test: The manufacturer shall have successfully tested a prototype of each engine/generator set series offered. The tests performed shall include the following:
  - a. Maximum power test.
  - b. Maximum motor starting kVA.
  - c. Transient response, steady state governing, and voltage regulation.
  - d. Single step load pick-up per NFPA 110.
  - e. Three-phase short circuit test for mechanical and electrical strength.
  - f. Fuel consumption.
  - g. Cooling system test.
  - h. Endurance run test.
  - i. Torsiograph analysis and test.
  - j. Temperature rise test.
2. Factory Tests: Prior to shipment, each unit shall be factory performance tested under load. Test results shall be certified and documented on a strip chart recorder. The tests shall be performed in accordance with the Manufacturer's standards and NFPA Standard 110. The following tests shall be performed:
  - a. Stepped load test at 1/2, 3/4, and full load for 5 minutes each step.
  - b. Three-quarter block load.
  - c. Full single step block load.
  - d. Results documented shall include steady-state voltage and frequency analysis, transient response, maximum power analysis, and fuel consumption.
3. Field Tests: Each complete installation shall be tested for compliance with the plans and specifications following completion of all site work. Testing shall be conducted by a representative of the supplier. The Contractor shall supply fuel, load bank, and other equipment required for the test. The Owner and Engineer shall be notified in advance and shall have the option to witness the tests. The tests shall be repeated until the equipment performs as specified. The tests to be conducted on site shall be as follows:
  - a. Cold Start Test: Perform a cold start test on the generator using

the generator's actual load as a test load. A power failure shall be simulated by opening the normal power disconnect and the following information shall be recorded:

- (1) Time delay on start.
  - (2) Cranking on time.
  - (3) Time required to come up to speed.
  - (4) Voltage and frequency overshoot.
  - (5) Time to achieve steady state.
  - (6) Voltage, frequency, and amps at standby state.
  - (7) Oil pressure, water temperature, and battery charge rate at 5-minute intervals for the first 15 minutes and at 15-minute intervals thereafter for 2 hours.
  - (8) Time delay on retransfer after return of normal power.
  - (9) Cool-down time delay.
- b. Full Load Test: Immediately after cooling time from cold start test, perform a one step full load test using a load bank. Record the same data as in the cold start test except for time delays on transfer and retransfer.
  - c. Crank Cycle Test: Disable the generator from starting by a method approved by the Manufacturer and test the crank cycle by switching the generator to run.
  - d. Safety Shutdowns: Test all the generator safety shutdowns.

#### **1.4 SUBMITTALS**

- A. See Section 01 33 00 - Submittal Procedures.
- B. Verify dimensions, coordination and applicability of equipment furnished.
- C. Full detail for performing of engine testing required. Upon completion of engine testing prepare and submit final results along with all new data.
- D. Upon satisfactory completion of startup, secure a written statement from manufacturer that each engine generator is installed in accordance with manufacturer's recommendations, properly started up and is ready for operation by the Owner's personnel. Also certify that required operation and maintenance training has been fully satisfied.
- E. Wiring diagrams for each engine-generator set. Indicate clearly factory versus field wiring connections.
- F. Generator fault current at full rpm and main circuit breaker trip curves and fault interrupting rating.
- G. Operation and Maintenance Manuals: See Section 01 78 5 - Project Closeout.

#### **1.5 WARRANTY**

- A. Comply with General Conditions.

## **PART 2 PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. **Caterpillar.**
  - 2. **Cummins/Onan.**
  - 3. **Generac.**
  - 4. **Kohler**
  - 5. **MTU**
  - 6. Approved equal.
- B. Assure engine, generator and accessories are provided by the engine manufacturer and its authorized dealer.
- C. Assure local availability of service and replacement parts.

### **2.2 PERFORMANCE AND OPERATING REQUIREMENTS**

- A. Operating Conditions: Provide complete generator sets, controls and accessories rated for the following conditions:
  - 1. Location: Saratoga Springs, Utah
  - 2. Altitude: 4,500 FT AMSL.
  - 3. Fuel: #2 diesel.
  - 4. Enclosure rating: Outdoors sound attenuated, Level 2..
- B. Performance: Establish net rating of each generator set under operating conditions specified when equipped and fully loaded with all necessary operating accessories. Substantiate ratings with manufacturer's standard published curves and data.
  - 1. Minimum ratings:
    - a. Standby rating (ea):
      - (1) 400 kW at 0.8 PF.
      - (2) Frequency: 60 HZ.
    - b. Voltage and phase: 480/3.
    - c. Engine speed, max: 1800 rpm.
    - d. Maximum voltage dip: 35 percent.
  - 2. Fuel: Engines requiring special or premium fuel will not be acceptable.
- C. Paralleling - The initial configuration is for one generator. In the future as the station expands a second generator will be added. The final pump expansion will include a third generator. The ratings of the future generators are estimated to be 400 kW. The supplied system shall consist of engine-generator set modules with internal paralleling equipment.
  - 1. The MPS system shall include one generator set module in which the

- prime mover shall be a liquid cooled, diesel fueled, turbocharged aftercooled engine of 4-cycle design. Ratings shall be as indicted.
2. Each generator shall include a single generator controller that performs all genset control and paralleling functions.
  3. Each generator shall include a cycle rated paralleling switch using proven contactor technology. The generator paralleling switch shall be mounted in the generator connection box. Solutions utilizing motor operate or stored energy breakers for generator paralleling shall provide documentation of cycle rated suitability.

## **2.3 ENGINE**

- A. Engine Construction: Provide diesel-type engine of heavy-duty construction, full compression ignition diesel, radiator and fan cooled, "V" type multi-cylinder, four stroke, four cycle.
1. Engines solid-state designed for cold quick start, capable of delivering full load output in 10 seconds.
  2. Engine must meet scheduled performance without turbo-charging or after-cooling.
  3. Engines shall have replaceable cylinder liners of wet sleeve-type and replaceable valve seat inserts.
  4. Design combustion chambers of open type.
  5. Cross tie bolt main bearing caps to crankcase for rigidity. Design connecting rods of forged steel, angle split line for precise cap alignments.
  6. Design crankshaft of forged steel.
  7. Provide exhaust manifolds.
- B. Lubrication:
1. Provide pressure-type lubrication system with gear-type oil pump and full flow filters fitted to engines. Provide pressure-regulating valve. Provide level indicator or dipstick.
  2. Locate filter for convenient servicing. Equip filters with spring loaded bypass to ensure oil circulation if filters are clogged.
  3. Oil drain piped to edge of skid with valve or cap.
- C. Air Cleaner:
1. Provide one or more dry-type replaceable element air cleaners suitable for high dust load operation.
  2. Equip each air cleaner with service indicator.
- D. Governor:
1. Provide a fully enclosed electronic governor.
  2. Frequency at any constant load shall not deviate more than plus or minus 0.5 percent of rated frequency.
  3. The governor to provide adjustable frequency regulation from

- 4. isochronous to 5 percent droop.  
Equal to Woodward 2301 single controller with an EGLOP Woodward actuator.
- E. Fuel System: Dual replaceable element filter, engine supply and return line, solenoid shut off valve, and engine driven fuel pump.

## **2.4 GENERATOR**

- A. Construction: Provide brushless, revolving field type, synchronous generator coupled directly to engine flywheel through a flexible driving disc for positive alignment.
  - 1. Bolt generator housing directly to engine flywheel housing.
  - 2. Provide (a single) double ball-bearing support for the rotor in the generator housing. Dynamically balance rotor for up to 25 percent overspeed.
  - 3. Provide Class H insulation operating on Class F temperature rise on the stator and rotor, and protect with 100 percent epoxy impregnation and an overcoat of resilient insulating material to reduce possible fungus and abrasion deterioration. Equip field with full amortisseur winding.
  - 4. Perform generator field excitation with static-type rotating exciter mounted on the generator rotor shaft through a brushless rotating diode system.
  - 5. Provide volts-per-hertz type voltage regulator of solid-state 3-phase sensing, construction matching characteristics of each unit. Provide no load to full load regulation within  $\pm 0.5$  percent at rated voltage during steady state conditions.
  - 6. Provide permanent magnet generator to provide excitation power to the automatic voltage regulator. Provide shock-resistant mounting of regulators.

## **2.5 COOLING SYSTEM**

- A. Provide unit-mounted radiator cooling system with sufficient capacity for cooling generator set at full rated load and operating conditions specified.
  - 1. Equip engine with engine-driven centrifugal-type water circulating pumps and thermostatic valve to maintain coolant temperature below 200 Deg F.
- B. Coolant:
  - 1. Flush and drain cooling system.
  - 2. Fill with minimum 50 percent ethylene glycol and water solution.
  - 3. Assure radiator, engine block and related items protected to minus 50 Deg F.
  - 4. Coolant drain piped to edge of skid with valve or cap.
- C. Jacket Water Heaters: Furnish one or more engine mounted thermal circulation type water heaters to maintain engine jacket water at 70 Deg F at minimum

ambient temperature specified.

1. Include integral thermostatic controls to maintain desired temperatures.
2. Rate heater for 240 V, 1 PH, 60 HZ.

## **2.6 EXHAUST SYSTEM**

- A. Exhaust Silencer. Provide a Critical-grade silencer and related hardware to include side inlet, standard 125-150 LB flange connections, companion-flanges, cleanouts, Type E support arrangement, and stainless steel bellows type flexible exhaust connectors at least 24 IN long.
  1. Ensure silencers and related hardware are properly sized and installed according to the manufacturer's recommendation.
  2. The silencer shall be mounted horizontally such that its weight is NOT supported by the engine. Silencer shall be mounted inside enclosure.
  3. Furnish and install exhaust pipe constructed of schedule 40 steel pipe with standard 125-150 LB flange connections as shown on the Drawings. Exhaust pipe size shall be sufficient to ensure that measured exhaust back pressure does not exceed 20-inches of water.
- B. Install insulation so that it does not interfere with the functioning of the flexible exhaust fitting.

## **2.7 STARTING SYSTEMS**

- A. Starting Motors: Provide 24 V DC starting system with solenoid operated positive engagement drive.
- B. Batteries: Furnish lead acid batteries with each engine generator with sufficient capacity to crank engines for three 20-second cranking periods with a 30-second rest period between cranks without recharging.
  1. Provide battery rack appropriately sized for the batteries furnished, painted with alkaline-resistant paint.
  2. Provide constant voltage, current limiting, full wave rectifier type battery chargers using silicon-controlled rectifiers as the power controlling elements.
  3. Provide float and equalize charge rates. Rate charger for 120 V, 1 PH, 60 HZ with output current rating to recharge the battery from a 70 percent discharged condition to 95 percent charged condition in 12 HRS.
  4. Provide malfunction alarm contacts for actuation of alarm in the event of malfunction in the battery charging system.
  5. Provide DC voltmeter and ammeter, ac input and dc output circuit breakers.
  6. Provide cables, clamps and all other necessary connections.
  7. Size main cables to exhibit total circuit resistant of 0.005 ohm or less.
  8. Batteries and charger located in generator enclosure.
  9. Starting shall be initiated by a normally open, dry contact closure.

## **2.8 CONTROLS**

### **A. Control Panel:**

1. Provide NEMA 1 enclosed control panel mounted on each generator terminal box with vibration isolators.
2. Construct dead front panel with 14 GA steel.
3. Include the following devices in panel:
  - a. Engine coolant temperature gage.
  - b. Engine lube oil pressure gage.
  - c. Engine lube oil temperature gage.
  - d. Engine running hour meter.
  - e. Battery charging indicators.
  - f. Voltmeter.
  - g. Ammeter with true RMS output, supplied by 3 CT's at generator output leads.
  - h. Ammeter and voltmeter phase selector switch or switches.
  - i. Frequency meter.
  - j. Manual and automatic starting controls.
  - k. Panel illumination lights and switch.
  - l. Voltage level adjustment rheostat.
  - m. Fault indicators including low oil pressure, high water temperature, overspeed and overcrank. Provide dry contacts for common annunciation of fault conditions.
4. Provide minimum 3-1/2 IN DIA, dial type meters. Accuracy shall be within  $\pm 2$  percent.

### **B. Main Line Circuit Breaker: Provide main circuit breaker for each generator set, sized as indicated on Contract Drawings.**

1. Breakers are to operate both manually for normal switching function and automatically during overload and short circuit conditions.
2. The trip unit for each pole of each breaker is to have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection.
3. Provide breakers to interrupt bolted 3 PH fault from generator at full rpm at load terminals.
4. Provide a NEMA 1 enclosure for circuit breakers and mount on generator using suitable vibration isolators.

## **2.9 AUTOMATIC TRANSFER SWITCH**

### **A. General**

1. The automatic transfer switch shall be furnished by the manufacturer of the engine-generator set so as to maintain system compatibility and local service responsibility for the complete emergency power system. Representative production samples of the transfer switch supplied shall have demonstrated through tests the ability to withstand at least 10,000 mechanical operation cycles. One operation cycle is the electrically



operated transfer from normal to emergency and back to normal. Wiring must comply with NEC table 312.6. The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system.

B. Ratings & Performance

1. The automatic transfer switch shall be a 4 pole design rated for 1,600 amps continuous operation in ambient temperatures of -20 degrees Fahrenheit (-30 degrees Celsius) to +140 degrees Fahrenheit (+60 degrees Celsius). Main power switch contacts shall be rated for 600 V AC minimum. The transfer switch supplied shall have a minimum withstand and closing rating of 65,000 amperes. Where the line side overcurrent protection is provided by circuit breakers, the short circuit withstand and closing ratings shall be 35,000 amperes RMS. These RMS symmetrical fault current ratings shall be the rating listed in the UL listing or component recognition procedures for the transfer switch. All withstand tests shall be performed with the overcurrent protective devices located external to the transfer switch.

C. Construction

1. The transfer switch shall be double throw construction, positively electrically and mechanically interlocked to prevent simultaneous closing and mechanically held in both normal and emergency positions. Independent break before make action shall be used to positively prevent dangerous source to source connections. When switching the neutral, this action prevents the objectionable ground currents and nuisance ground fault tripping that can result from overlapping designs. The transfer switch shall be approved for manual operation under no load conditions. The electrical operating means shall be by electric solenoid. Every portion of the contactor is to be positively mechanically connected. No clutch or friction drive mechanism is allowed, and parts are to be kept to a minimum. This transfer switch shall not contain integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
2. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy with arc chutes to resist burning and pitting for long life operation.
3. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy with arc chutes and separate arcing contacts to resist burning and pitting for long life operation.

D. Controls

1. All control equipment shall be mounted on the inside of the cabinet door in a metal lockable enclosure with transparent safety shield to protect all solid state circuit boards. This will allow for ease of service access when main cabinet lockable door is open, but to prevent access by unauthorized personnel. Control boards shall have installed cover plates to avoid shock hazard while making control adjustments. The solid state voltage sensors and time delay modules shall be plug-in circuit boards with silver or gold contacts for ease of service.
2. A solid state undervoltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. A utility sensing interface shall be used, stepping down system voltage of 480Y/277 vac 3 phase to 24VAC, helping to protect the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.
3. A solid state undervoltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. A utility sensing interface shall be used, stepping down system voltage of 480Y/277 vac 3 phase to 24VAC, helping to protect the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.
4. Signal the engine-generator set to start in the event of a power interruption. A set of contacts shall close to start the engine and open for engine shutdown. A solid state time delay start, adjustable, 0.1 to 10 seconds, shall delay this signal to avoid nuisance start-ups on momentary voltage dips or power outages.
5. Transfer the load to the engine-generator set after it reached proper voltage, adjustable from 70-90% of system voltage, and frequency, adjustable from 80-90% of system frequency. A solid state time delay, adjustable from 5 seconds to 3 minutes, shall delay this transfer to allow the engine-generator to warm-up before application of load. There shall be a switch to bypass this warm-up timer when immediate transfer is required.
6. Retransfer the load to the line after normal power restoration. A return to utility timer, adjustable from 1-30 minutes, shall delay this transfer to avoid short term normal power restoration.
7. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.
8. Signal the engine-generator to stop after the load retransfers to normal. A solid state engine cool down timer, adjustable from 1-30 minutes, shall permit the engine to run unloaded to cool down before shutdown. Should the utility power fail during this time, the switch will immediately transfer back to the generator.
9. Provide an engine minimum run timer, adjustable from 5-30 minutes, to

- ensure an adequate engine run period.
- 10. The transfer switch shall have a time delay neutral feature to provide a time delay, adjustable from 0.1-10 seconds, during the transfer in either direction, during which time the load is isolated from both power sources. This allows residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle. A switch will be provided to bypass all transition features when immediate transfer is required.
- 11. The transfer switch shall have an in phase monitor which allows the switch to transfer between live sources if their voltage waveforms become synchronous within 20 electrical degrees within 10 seconds of transfer initiation signal. A switch must be provided to bypass this feature if not required.
- 12. If the in phase monitor will not allow such a transfer, the control must default to time delay neutral operation. Switches with in phase monitors which do not default to time delay neutral operation are not acceptable.
- 13. Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system in less than one minute, or AUTOMATIC mode to set the system for normal operation.
- 14. Provide bright lamps to indicate the transfer switch position in either UTILITY (white) or EMERGENCY (red). A third lamp is needed to indicate STANDBY OPERATING (amber). These lights must be energized from utility or the engine-generator set.
- 15. Provide manual operating handle to allow for manual transfer. This handle must be mounted inside the lockable enclosure so accessible only by authorized personnel.
- 16. Provide a maintenance disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.
- 17. Provide LED status lights to give a visual readout of the operating sequence. This shall include utility on, engine warm-up, standby ready, transfer to standby, in phase monitor, time delay neutral, return to utility, engine cool down and engine minimum run. A "signal before transfer" lamp shall be supplied to operate from optional circuitry.
- 18. The switch shall include dry contact auxiliary contacts for monitoring the utility and generator positions.

## 2.10 ACCESSORIES

- A. Weather-Protective Housing: Reinforced steel housing allowing access to control panels and service points, with lockable gasketed doors (one(1) set of double doors at the circuit breaker panel and three (3) single access doors). Include fixed louvers, not less than 14 gage sheetmetal for housing walls, battery racks and silencer. Caulk all enclosure panel joints. Provide generator in a Level 2 Weather Housing. The enclosure shall provide a sound level of 72 dBA measured at seven (7) meters from the enclosure. Housing shall also include:
  - 1. Galvanized, wire mesh bird screen on the inside of the air intake louvers.

2. Upflow radiator discharge only.
3. Provide interior lighting.
4. Battery Trays: Fiberglass tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.
5. Provide a 120 VAC GFCI receptacle inside the weather enclosure for maintenance purposes.

## **2.11 SPARE PARTS**

- A. Furnish Owner the following extra parts and supplies for each generator set:
  1. One complete set of belts.
  2. Two sets of filters, i.e., fuel, oil, and air.
  3. Oil for one complete oil change.
  4. One complete set of control panel indicating lights.
  5. Complete replacement set of all fuses.
- B. Spare parts shall be suitably packaged with labels indicating contents of each package.

## **PART 3 EXECUTION**

### **3.1 MOUNTING, FUEL TANK AND ENCLOSURE**

- A. Base: Mount engine, generator and cooling system on a common structural steel subbase capable of maintaining unit alignment suitable for mounting unit on a base fuel tank. Equip subbase with vibration isolators between subbase and fuel tank.
- B. Fuel Tank: Provide double-wall welded steel UL listed base tank assembly designed and supplied by the generator manufacturer.
  1. Size tank for minimum 24 HRS of continuous engine operation at full load.
  2. Provide mounting and anchoring means suitable for installation on concrete pad.
  3. Provide double wall construction with leak detection and alarm contact.
  4. Provide low fuel level alarm contact.
- C. Flexible Connections: Provide stainless steel flexible fittings on all engine piping and electrical conduits.
  1. Engine control conduit.
  2. Fuel connection: Braided metallic.
  3. Exhaust connector bellows: Stainless steel.
  4. Coolant water pipes: Braided metallic.
- D. Enclosure:
  1. Provide the generator and engine as outdoor lockable Level 2 sound

attenuating enclosure. Generator will be installed outdoors on a concrete pad..

- E. Provide a complete exhaust system to install the engine exhaust system as required by the factory . Provide all appropriate insulating materials, mounting hardware, supports, for a complete installation.

### **3.2 FIELD QUALITY CONTROL**

- A. Employ and pay for services of equipment manufacturer's field service representative(s) to:
  - 1. Inspect equipment covered by these Specifications.
  - 2. Supervise any adjustments and installation checks.
  - 3. Conduct initial start up of equipment and perform operational checks at job site. Conduct field tests as specified.
  - 4. Provide instruction to Owner's personnel on training in operation and maintenance of equipment for a 4 hour period for each engine generator set.

### **3.3 TESTING**

- A. Provide services of authorized manufacturer's technician to start, test, and adjust system for proper operation.
- B. Provide services of factory trained and authorized technician to give Owner a 4 hour class in proper operation and maintenance.
- C. Site Acceptance Test:
  - 1. Prior to performing any on-site testing of the generator or associated systems, the generator vendor must demonstrate to the Owner that all generator shut-downs and alarms are working. This includes all remote annunciators included with the emergency generator system. The system must be operational and working before proceeding. Any item that fails must be repaired before proceeding with the testing.
  - 2. The complete standby generator set shall be tested under the supervision of capable service engineers provided by the diesel engine-generator manufacturer. (Submit a detailed chronological test plan with the Shop Drawings.) Prior to any testing, verify that the set is complete and ready for testing and that all instrumentation required is connected and ready for Start-up and test. Tests shall be witnessed by the Owner's representatives. Provide necessary lube oil, fuel oil, and testing equipment to obtain full load conditions, including any required additional resistive load banks, for the system test.
  - 3. The on-Site test program shall cover the following as a minimum:
    - a. Verify that all components are correctly installed and interconnected. Exercise each circuit breaker, and each automatic transfer switch, including its draw out mechanisms.
    - b. Individually test each engine protective device and verify the

accuracy of instrumentation set points. Provide coordination study for each overcurrent and ground fault device and calibrate same at the Project Site by means of primary injection testing before any tests are performed. Coordination study shall be submitted with Shop Drawings.

- c. The diesel generator set shall operate under full load conditions for a minimum of four (4) hours. The generator set shall maintain rated voltage and rated frequency per Specifications for the duration of the full load test. Voltage, amperage and frequency measurements, as well as engine gauge and monitor points, shall be recorded at 15 minute intervals. All doors of the weatherproof housing shall remain closed during testing.
  - d. Operate the diesel engine-generator from 0 to 100 percent load, starting at no-load and increasing in increments of 25 percent. Hold at each incremental load for 15 minutes and check at each load point for stable operation, fuel consumption, engine performance, and generator performance. The generator shall be capable of returning to its rated voltage and frequency per Specifications when incremental loads are added.
  - e. Verify acoustical performance, if the enclosure is so rated, with the diesel engine generators operating at full load.
4. Provide all labor and materials required for on-Site testing with 100 percent load at unity power factor, including but not limited to, the following:
- a. Overcurrent and short-circuit protection devices, contactors, relays, etc., for temporary cables, as required.
  - b. All instrumentation and connections required to measure and record test data. Provide accurate voltage, current, frequency, and kW meters to accomplish this. For each transient or load change, provide oscillograph trace recordings of voltage frequency and current, showing the entire restabilization period for each. Record and log all test data and submit to Owner in a comprehensive test report.
  - c. Disconnection and removal of all temporary power and control wiring and equipment.
  - d. Provide all fuel required for the test. After the test and prior to final acceptance the Contractor shall fill the fuel tanks to full level.
5. A final system test (pull-the-plug) to demonstrate the system as a whole, including safeties, etc., shall be conducted to the satisfaction of the Owner/Engineer. This test shall not be conducted as an extension of the Site acceptance test, but rather as a separate test after Substantial Completion and acceptance of all other Work associated with this Project. Submit a detailed chronological test plan with the Shop Drawings.
6. Any item documented as being failed or not working will be submitted to the vendor for repair. The vendor has five (5) working days to either fix the item or respond in writing why the item is not being repaired. If the item is not repaired or no response is received in five (5) working days, the Owner will make repairs and deduct the cost of repairs from the final payment of the generator.

-- END OF SECTION --

**SECTION 26 42 00**  
**GALVANIC CATHODIC PROTECTION SYSTEM**

**PART 1 GENERAL**

**1.1 WORK INCLUDED:**

- A. This section covers the work necessary to furnish and install a galvanic anode cathodic protection system, including test stations, electrical isolation, and pipe joint bonds for electrical continuity on buried steel and ductile iron piping, complete.
- B. CONTRACTOR to have a third party Corrosion Expert to perform CONTRACTOR required quality control testing as defined this section.

**1.2 STANDARDS**

- A. The following standards are included by reference:
  - 1. NACE SP-0169
  - 2. NACE SP-0177

**1.3 RELATED SECTIONS**

- A. Related work is specified in other sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 33 05 05 Ductile Iron Pipe
  - 3. Section 33 12 00 Mechanical Appurtenances
  - 4. Section 33 92 10 Steel Pipe, Specials and Fittings

**1.4 QUALIFICATIONS**

- A. All CONTRACTOR specified testing shall be performed by a third party Corrosion Expert whom holds a current NACE accreditation as a Cathodic Protection Specialist (CP-4) or Cathodic Protection Technologist (CP-3), and/or a registered professional engineer.
- B. CONTRACTOR performed quality control testing shall include the following tests, which shall be performed as defined this section.
  - 1. Joint Bond Resistance test
  - 2. Insulating Joint Testing
- C. Connection of galvanic anodes, energizing and testing of cathodic protection system, and other tests as defined under "System Tests and Inspections" shall be performed by ENGINEER unless specifically stated otherwise this section.

**1.5 DEFINITIONS**

- A. Electrically Continuous Pipeline: A pipeline which has a linear electrical resistance equal to or less than the sum of the resistance of the pipe plus the maximum allowable joint bond resistance for each bonded pipe joint as specified in this section.

- B. Electrical Isolation: The condition of being electrically isolated from other metallic structures (including, but not limited to, piping, reinforcement, casings) and the environment as defined in NACE Recommended Practice SP0169
- C. Ferrous Metal Pipe: Pipe made of steel or iron, or pipe containing steel or iron as a principal structural material, except reinforced concrete pipe.
- D. Foreign-Owned: Buried pipe or cable not owned or operated by Owner.
- E. Lead, Lead Wire, Joint Bonds, Pipe Connecting Wires, Cable: Insulated copper conductor; the same as wire.
- F. Insulating (Isolation) Flange: Used to electrically separate piping for the purpose of preventing cathodic protection current losses, separating dissimilar material, and separating new and old piping

## **1.6 SUBMITTALS**

- A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Shop Drawings: Catalog cuts, laboratory report, and other information for products proposed for use.
- C. Quality Assurance Submittals:
  - 1. Manufacturers' Certificates of Compliance.
  - 2. Field Test Reports.
  - 3. Qualifications of NACE Accredited Testing Personnel.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Provide insulating flanges at the following locations within the pump station:  
Between all pump can suction flanges and suction pipes  
At each flange on the 24-inch, 16-inch, and 14-inch diameter discharge pipes at ductile iron pipe to welded steel pipe transition above the pump station floor.
- B. Double-wire-bond each joint on each buried pipeline, including ductile iron pipes, valves, dismantling joints, etc.
- C. Provide one, post-style test for each of the following three (3) pipes and label each test station post at the north side of the pump station north fence line, as follows:  
  
24-inch diameter Zone 1 Pipe .  
24-inch diameter Zone 2 Pipe  
16-inch diameter Zone 2 Pipe
- D. Like items of materials provided hereunder shall be the end product of one manufacturer to achieve standardization for appearance, maintenance, and replacement.



- E. Materials and workmanship shall be installed concurrently with pipe installation. Coordinate all work specified herein with related sections.

## 2.2 SUPPLIERS

- A. Alternate suppliers will be considered, subject to approval of ENGINEER. Address given is that of the general office; contact these offices for information regarding the location of their representative nearest the project site.
1. Corpro, Inc., Chicago, IL
  2. Farwest Corrosion Control, Gardena, CA
  3. MESA Products, Tulsa, OK

## 2.3 JOINT BONDS

- A. General:
1. All joint bonds provided either by pipe manufacturer or CONTRACTOR shall meet the following minimum requirements:
    - a. All connections on a joint bond shall be welded or soldered. Mechanical or compression type connections will not be permitted.
    - b. Bonds and welds shall exhibit sufficient strength or flexibility to allow thermal movement of the pipe after pipe backfill without cracking or breakage.
    - c. Bond connections to pipe shall be with an ENGINEER approved thermite welding method.
  2. All installed bonds shall be insulated or coated copper with all exposed copper field coated to prevent galvanic corrosion of the pipe.
- B. Steel, Ductile, or Ductile Iron Pipe:
1. Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE insulation, 18 inches long, with formed copper sleeve on each end of the wire.
  2. Quantity of joint bonds per pipe joint shall be as defined below:

Bond Type	Two Bonds	Three Bonds	Four Bonds
#2 AWG Wire	16" or less	42" or less	Over 42"

## 2.4 PREPACKAGED GALVANIC ANODES

- A. High-Potential Magnesium Alloy:
1. Composition:
    - a. Aluminum: 0.01 percent maximum.
    - b. Manganese: 0.5 to 1.3 percent.
    - c. Zinc: 0.0
    - d. Silicon: 0.0
    - e. Copper: 0.02 percent maximum.
    - f. Nickel: 0.001 percent maximum.
    - g. Iron: 0.03 percent maximum.
    - h. Total Others: 0.05 percent each or 0.3 percent maximum.
    - i. Magnesium: Remainder.
  2. Dimensions:

- a. Length: 30 inches minimum.
  - b. Bare Weight: 32 pounds minimum.
- 3. Manufacturers and Products:
  - a. Dow; Galvomag.
  - b. Amax; Maxmag.
  - c. Or approved equal.
- B. Anode Wire: Furnish each anode with No. 12 AWG solid copper wire with THWN insulation, 10 feet long.
- C. Wire-to-Anode Connection: Manufacturer's standard. The anode connection shall be stronger than the wire.
- D. Backfill:
  - 1. Composition:
    - a. Ground Hydrated Gypsum: 75 percent.
    - b. Powdered Wyoming Bentonite: 20 percent.
    - c. Anhydrous Sodium Sulfate: 5 percent.
  - 2. Grain Size: 100 percent passing through a 20-mesh screen and 50 percent retained by a 100-mesh screen.
  - 3. Mixture: Thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag or cardboard tube by means of adequate vibration.
  - 4. The quantity of backfill shall be sufficient to cover surfaces of the anode to a depth of 1 inch.

## 2.5 CATHODIC PROTECTION TEST STATIONS

- A. Post Style, Steel Conduit:
  - 1. Test Box:
    - a. Cast aluminum with thread hub suitable for mounting to a 2-inch x 3-inch street reducer or directly to 3-inch rigid conduit. Reducing bushings will not be permitted.
    - b. Manufacturer and Product:
      - (1) Type T and I Stations: Gerome Manufacturing, Testox 700 series (rectangle).
      - (2) Type A Stations: Gerome Manufacturing, Testox 2000 series (rectangle) with 2-inch or 3-inch threaded hub.
      - (3) Or approved equal.
  - 2. Street Reducer:
    - a. Hot dipped galvanized 2-inch x 3-inch reducer and close nipple.
  - 3. Terminal Block:
    - a. Plastic or glass-reinforced laminated, 1/4-inch thick with seven terminals for Type T, C, and I test stations.
    - b. Plastic or glass-reinforced laminated, 1/4-inch thick with eleven terminals for Type F, A, and TR test stations.
    - c. Terminal heads shall have special heads to keep them from turning or shall be easily accessible from both sides of the terminal block without requiring its removal.
    - d. Terminal studs, washers, and nuts shall be stainless steel.

4. Mounting Structure:
  - a. Rigid hot dipped galvanized steel conduit 3-inches diameter, threaded at one end (minimum), length as required for installation requirements.
  - b. PVC long radius sweep elbow, 1-inch diameter, for wire protection as shown on Drawings.
- B. Flush Style, Vehicular Traffic (Type 2 – Not Used UNO):
  1. Test Box: Concrete body cast with a cast iron ring, with a minimum weight of 55 pounds and minimum dimensions of 9-inch inside diameter and 12 inches long.
  2. Furnish extensions as required to penetrate concrete surfaces by 4 inches minimum.
  3. Furnish with a 14-pound cast iron lid with the words "CP Test" cast into the lid.
  4. Manufacturer and Products: Brooks; Models 3RT or Christy Oldcastle Model G05, or approved equal.
- C. Flush Style Terminal Boards (not used UNO):
  1. Dimensions: 5-inch by 8-inch by 1/4 inch thick
  2. Material: Phenolic, micarta, or fiberglass.
  3. Terminals: Stainless steel bolts, double nuts, double flat washers, lock washer, and shunt. Quantity and placement as shown on the Drawings..
  4. Labels: Engrave terminal board with label of each terminal as shown on the Drawings and with the OWNER's name and contact number.

## 2.6 WIRE

- A. Pipe and Test Lead Wires:
  1. No. 10 AWG wire, single-conductor, stranded copper with 600-volt, TW, THWN, or HMWPE insulation. Color coded insulation as specified.
  2. Insulation Color: Color shall indicate the function of each test wire and shall be as follows:
 

a. Pipe:	White
b. Anode:	Black
c. Insulating Joints:	White or Green as shown on Drawings
d. Reference Electrode:	Yellow

## 2.7 CONDUIT, LOCKNUTS, AND STRAPS

- A. Outdoors, Exposed Conduit
  1. Rigid conduit shall be rigid galvanized steel.
  2. Fittings, junction boxes, pull boxes, and outlet bodies shall be hot-dipped galvanized iron.
  3. Locknuts, conduit clamps, and other miscellaneous hardware shall be hot dipped galvanized steel. Galvanized items shall be hot-dipped galvanized in accordance with ASTM A153.
  4. Conduit clamps shall be 2-piece, malleable iron, 1-hole, strap and clamp back spacer, O. Z. Gedney 14-100G and 143G or similar, for mounting to surfaces with either lag bolts or concrete wedge anchors, as shown on the Drawings.

- B. Buried Conduit:
1. Conduit shall be rigid electrical grade schedule 40 gray PVC.
  2. Locknuts, two-hole straps, and other miscellaneous hardware shall be galvanized steel. Galvanized items shall be hot-dipped galvanized in accordance with ASTM A153.

## 2.8 THERMITE WELD MATERIALS

- A. General:
1. Thermite weld materials consist of wire sleeves, welders, and weld cartridges according to the weld manufacturer's recommendations for each wire size and pipe or fitting size and material.
  2. Welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers is not acceptable.
- B. Molds: Graphite, as recommended by manufacture for pipe and wire size.
- C. Adapter Sleeves:
1. For No. 12 AWG and No. 2 AWG wires.
  2. Prefabricated factory sleeve joint bonds or bond wires with formed sleeves made in the field are acceptable. Attach field-formed joint bonds sleeves with the appropriate size and type of hammer die furnished by the thermite weld manufacturer.
  3. Extend wire conductor 1/8 inch beyond the end of the adapter sleeve.
- D. Cartridges:
1. Steel: 32 grams, maximum.
  2. Cast and Ductile Iron: 45 grams, maximum, XF-19 Alloy
- E. Welders and Cartridges: For attaching copper wire to pipe material:

Pipe Material	Weld Type	Cartridge Size, Max.
<b>No. 6 AWG Wire &amp; Smaller</b>		
Steel	HA, VS, HC	15 gm
Ductile or Cast Iron	HB, VH, HE	25 gm
<b>No. 4 AWG Wire &amp; Smaller</b>		
Steel	HA, VS, HC	25 gm
Ductile or Cast Iron	HB, VH, HE	32 gm
<b>No. 2 Wire Joint Bonds</b>		
Steel	FS	32 gm
Ductile or Cast Iron	FC	45 gm

- F. Welding Materials Manufacturers:

1. Erico Products Inc. (Cadweld), Cleveland, OH.
2. Continental Industries, Inc. (Thermo-Weld), Tulsa, OK.

## **2.9 COATING REPAIR MATERIAL FOR PIPE AND FITTINGS**

- A. General:
  1. Complete coating repairs in accordance with recommendations of the pipe or fitting manufacturer.
- B. Coating Requirements:
  1. Steel Pipes:
    - a. Coal tar based coatings: Koppers Bitumastic 50 or Denso or Tapecoat wax tape coatings; or approved equal, 20 mils dry film thickness, minimum.
    - b. Polyurethane or Epoxy Coatings: Fast cure epoxy, 20 mils dry film thickness, minimum
    - c. Tape Wrap or Extruded Polyethylene Coating: Thermite Weld Cap, Canusa CRP Patch, or Raychem PERP patch, or approved equal
    - d. Cement Mortar Coating: Same as required for Concrete Cylinder Pipe.
  2. Ductile iron Pipe:
    - a. Fast cure epoxy
    - b. Thermite weld cap
- C. Coating Materials:
  1. Thermite Weld Caps:
    - a. Royston Laboratories Handi-Cap IP, prefabricated primerless thermite weld cap and coating system.
    - b. Provide primer unless specifically stated in product data sheet that no primer is required.
  2. Fast Cure Epoxy Coating:
    - a. 100 percent solids, fast curing epoxy suitable for submerged or buried conditions.
    - b. Acceptable products or approved equal:
      - (1) Denso Protal 7125 (low temperature) or Protal 7300
      - (2) Tapecoat TC 7010
      - (3) 3M ScotchKote 323

## **2.10 INSULATING JOINTS**

- A. General: Insulating joints shall be dielectric unions or flanges. The complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline. All materials shall be resistant for the intended exposure, operating temperatures, and products in the pipeline.
- B. Insulating Flanges:
  1. Gaskets:
    - a. Full-face, fiberglass (G10) with O-ring seal gasket. Buried insulating flanges shall be full face gaskets only.
    - b. Complete assembly shall have an ANSI rating equal to the flanged joint.

- c. Gasket materials shall be resistant to intended chemical exposure, operating temperatures, and pressures in the pipeline.
- 2. Insulating Sleeves: Full-length Mylar or fiberglass reinforced epoxy (NEMA G-10 grade).
- 3. Insulating Washers: Fiberglass reinforced epoxy (NEMA G-10 grade).
- 4. Steel Washers: Plated, hot-rolled steel, 1/8-inch thick.
- 5. Manufacturers:
  - a. GPT industries, Houston, TX.
  - b. Advanced Products and Systems, Scott, LA
  - c. Central Plastics Co., Shawnee, OK.
- C. Insulating Unions: O-ring sealed with molded and bonded insulating bushing to union body, by Central Plastics Company, Shawnee, OK; or approved equal.

## **2.11 CONCRETE**

- A. ASTM C94-90, Option A
- B. Cement: ASTM C150-89, type II with minimum cement content of 6.5 bags (611 pounds) per cubic yard.
- C. Coarse Aggregate Size:  $\frac{3}{4}$  inches
- D. Minimum Compressive Strength: 4,000 psi at 28 days with maximum water-cement ratio of 0.45.
- E. Air Entrainment:
  - 1. ASTM C260, nontoxic after 30 days and containing no chlorides.
  - 2. Not less than 5 nor more than 7.5 percent entrained air at the project site.

## **2.12 OTHER MISCELLANEOUS MATERIALS**

- A. Test Station Wire Terminations: One-piece, tin-plated crimp-on ring tongue connector as manufactured by Burndy Co. or Thomas and Betts.
- B. Shunts: Shunts shall be 0.01-ohm Holloway Type RS.
- C. Equipment Supports
  - 1. Material: Steel, ASTM A36, standard channel shape, size per Drawings.
  - 2. Coating: Hot-dip galvanized after fabrication in accordance with ASTM A153.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Installation of facilities herein specified shall conform to latest applicable NEC rules.
- B. Workmanship shall be of the highest grade and shall be in strict accordance with material manufacturer's instructions. Equipment or materials damaged in shipment or in the course of installation shall be replaced.

- C. Examine all Drawings and coordinate Work so as to avoid conflicts, errors, delays, and unnecessary interference with the construction of the facilities and to avoid duplication of the work such as excavation, filling, etc. In the event of any conflicts in the Specifications, ENGINEER shall be consulted.
- D. Install cathodic protection system at same time as pipeline installation as specified in other sections.

### **3.2 STORAGE AND HANDLING**

- A. Store all prepackaged anodes off the ground and keep them dry at all times. Protect against weather, condensation, and mechanical damage.
- B. Immediately remove from the project site all mechanically damaged anodes.
- C. Galvanic anodes shall not be lifted or held by the lead wire.
- D. Anode backfill material that has become wet will not be acceptable.

### **3.3 PIPE JOINT BONDING**

- A. To form an electrically continuous pipeline and associated appurtenances, all steel and iron pipe joints shall be electrically bonded; including buried, vault, and manhole pipe, fittings, and restrained joints; except threaded, welded, or insulated joints.
- B. Bond all joints at connections to existing ductile iron or steel pipe.
- C. Install the quantity of joint bonds at each joint required to be bonded as specified this section or shown on the Drawings. Should the specifications and drawings conflict, the larger quantity will apply.
- D. Electrical connection of bonds to pipe and fittings shall be by thermite welding process. Bolted, compression, or mechanical connections will not be permitted.
- E. CONTRACTOR shall test each bonded joint for electrical resistance as specified under CONTRACTOR QUALITY CONTROL TESTING, this section.

### **3.4 TEST STATION INSTALLATION**

- A. General:
  - 1. Test station location, type, and style shall be as shown on the Drawings.
  - 2. CONTRACTOR may relocate test station up to  $\pm 25$  feet for site conditions without ENGINEER approval. Relocation greater than  $\pm 25$  feet must be approved by ENGINEER.
  - 3. CONTRACTOR to maintain records showing actual pipeline stationing of test station wire connections to the pipe.
  - 4. Test stations shall be generally located as follows:
    - a. Install Type T test stations or other type test stations as required or at 1/4 mile intervals, but not greater than 1,500 feet.

- b. Install a Type I test station at all buried insulated joints.
- 5. Locate post-mounted test stations directly over the pipe and, where possible, at protected locations such as fences, manholes, power poles, or edges of cultivated land.
- B. Style: Use steel "post style" test stations except where "flush mount" test stations are specifically called out.
- C. Installation:
  - 1. Post mounted test station:
    - a. Height shall be 36 and 42 inches above finish grade.
    - b. In areas with livestock, test station height shall be between 48 and 60-inches.
    - c. Post shall be concrete encased as shown on the Drawings.
  - 2. Flush Mounted Test Stations
    - a. Place in concrete pad or sidewalk with cast iron cover as shown on Drawings.
    - b. Place concrete box on top of 3-inch base of compacted sand.
- D. Test Wires:
  - 1. Wires shall be attached to the pipe as specified under WIRE CONNECTIONS, this section.
  - 2. Wire connections shall be an individual connection with not less than 6-inches separation from other connections. Common connections will not be allowed. Where a steel tab is welded to pipe for test wire connections, a separate tab shall be provided for each wire connection.
  - 3. Wires shall be buried a minimum of 24 inches below finished grade, except in undeveloped or cultivated areas where test wires shall be a minimum of 30-inches below finished grade.
  - 4. Wires shall be direct buried except where test station offset is required. Offset wires shall be installed in PVC coated rigid steel conduit from the centerline of the pipeline to 6-inches from test station. Rigid conduit shall not be connected to the test station.
  - 5. Provide 12-inch diameter loop in wires at the pipeline connection, at each end of rigid conduit when required, and below post mounted test stations to prevent wires from being stressed or broken.
  - 6. Maintain sufficient slack in flush mount test wires to permit extension of terminal block 18-inches above test station. Connect all wires to a terminal board as specified.
  - 7. Make wire connections to test station terminals with crimp-on ring tongue terminals, except where solid wire is specified.



### **3.5 THERMITE WELD WIRE CONNECTIONS**

- A. Use thermite weld method for electrical connection of copper wire to steel, ductile iron, and cast iron surfaces. Observe proper safety precautions, welding procedures, thermite weld material selection, and surface preparation as recommended by the material manufacturer. Assure that pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the pipe or fitting wall's integrity or damage the lining in any way.
- B. Before the connection is made, the surface shall be cleaned to bare metal by making a 2-inch by 2-inch window in the coating, and then filing or grinding the surface with a vitrified wheel to produce a bright metal finish. Wire sleeves shall be installed on the ends of the wire before welding to the metal surface.
- C. After the weld connection is cooled, remove slag, visually inspect, and physically test wire connection by hitting with a hammer. Remove and replace any defective connections.
- D. Make wire connections to concrete cylinder pipe by thermite welding to the shop welded steel plates provided on the pipe for this purpose.
- E. Coat each completed wire connection as specified, this section. If lining is damaged by welding, repaired in accordance with the lining applicator's recommendations.

### **3.6 TRENCHING AND BACKFILL**

- A. General
  - 1. Complete excavations and trenching regardless of the type, nature, or condition of materials encountered, and as required to accomplish specified construction to lines and grades shown.
  - 2. CONTRACTOR shall complete all utility notifications prior to performing trenching and excavations work.
  - 3. Take care to avoid damage to existing structures and utilities during excavating and trenching process. CONTRACTOR may modify location, where approved by the ENGINEER, to minimize possible damage to existing structures. Trench shall be of uniform depth and width, level, smooth, and free of sharp objects.
  - 4. Trench Depths: Trench depths vary for conditions and requirements. Trench depths provided are minimum requirements. CONTRACTOR to meet minimum requirements or that required by local utilities, ordinances, or regulations, whichever is more stringent.
  - 5. Minimum depths for cathodic protection or corrosion monitoring work shall be as defined herein or shown on the Drawings. If in conflict, the more stringent shall apply.
    - a. Pipeline Test wires, undeveloped 24-inches (direct bury)
    - b. Pipeline Test wires, roadways 30-inches (conduit)
    - c. All other 30-inches

6. Safety: Slope, shore, or brace excavations and trenches in accordance with OSHA regulations as necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public. CONTRACTOR has sole responsibility for ensuring safety of trenches and conformance to OSHA trench safety requirements.
7. Backfill and Compaction.
  - a. Backfill trench with excavated backfill materials, UNO.
  - b. Compaction requirements shall be as specified for the pipeline or 90 percent compaction, whichever is more stringent. Backfill within 5 feet of roadways, paved areas, or other traffic areas shall be compacted to 95 percent.
  - c. Do not use backfill material of frozen or consolidated debris. Leave the trench with the excess backfill material neatly mounded, but not more than 4 inches above the existing ground level, for the entire width of the trench in undeveloped areas.
  - d. Replace topsoil in developed, landscaped, or cultivated areas.

### **3.7 CONDUITS**

- A. Secure conduits entering cabinets, junction boxes, or terminal boxes with double locknuts, one on the outside and one on the inside.
- B. Install conduit parallel to walls, floors, or posts, and either plumb or horizontal. All changes in direction shall be at 90 degrees using either radius bends or outlet boxes. Conduit crossings shall be perpendicular to the other conduit or pipe.
- C. Install insulated bushings and insulated throat connectors on the ends of rigid metallic conduit.
- D. Use watertight couplings and connections. Install and equip boxes and fittings to prevent water from entering the conduit or box. Seal unused openings.

### **3.8 WIRE INSULATION REPAIR**

- A. Underground splicing of wire will not be permitted, except where specifically shown on the drawings and approved by ENGINEER.
- B. Where splicing is approved by ENGINEER, splices shall mechanically secure and soldered with rosin cored 50/50 solder. Compression connectors will not be permitted.
- C. Splices or insulation damage to test station wires shall be spirally wrapped with two coats of high-voltage self-vulcanizing rubber splice tape and two layers of vinyl electrical tape.

### **3.9 INSULATED JOINTS**

- A. Install insulated joints to electrically isolate the pipeline from other pipes or structures where shown on the Contract Drawings.

- B. Install insulated joints as shown on the Contract Drawings.
- C. Align and install insulating joints according to the manufacturer's recommendations to avoid damaging insulating materials.
- D. Install a Type I test station at each buried insulated joint.
- E. CONTRACTOR shall test each insulated joint for electrical insulation as specified this section. Defective insulating joints shall be repaired by CONTRACTOR at his sole expense. All damaged or defective insulation parts shall be replaced.

### **3.10 QUALITY CONTROL TESTING**

#### **A. General:**

- 1. CONTRACTOR shall correct all construction defects identified during testing.
- 2. Provide ENGINEER with 7 days advance notice of completion for ENGINEER acceptance testing.
- 3. CONTRACTOR required testing as defined herein shall be performed by a Corrosion Expert, with qualifications as specified this section, whom is an employee or subcontractor to CONTRACTOR.

#### **B. Joint Bond Resistance Test:**

- 1. General
  - a. CONTRACTOR shall test completed joint bonds for electrical continuity using a digital low resistance ohmmeter.
  - b. Joint bond quality control test shall be performed on all bonded joints after the bonds are installed but before backfilling of the pipe.
  - c. Furnish all equipment and materials as required for test.
- 2. Digital Low Resistance Ohmmeter Test Method:
  - a. Required Equipment And Materials:
    - (1) One Biddle Model 247001 digital low resistance ohmmeter.
    - (2) One set of duplex helical current and potential handspikes, Biddle Model No. 241001, cable length as required.
  - b. Test Procedure:
    - (1) Measure the resistance of joint bonds with the low resistance ohmmeter in accordance with the manufacturer's written instructions.
    - (2) Use the helical handspikes to contact the pipe on each side of the joint, without touching the thermite weld or the bond. The contact area shall be cleaned to bright metal by filing or grinding and without any surface rusting or oxidation.
    - (3) Record the measured joint bond resistance on the test form described herein.
    - (4) Repair any damaged pipe coating in accordance with WIRE CONNECTIONS, this section.
- 3. Joint Bond Acceptance:
  - a. Joint bond resistance shall be less than or equal to the maximum allowable bond resistance values shown below.

Joint Type	Max. Allowable Resistance (micro-ohms)		
	Two Bonds/Joint	Three Bonds/Joint	Four Bonds/Joint
No. 2 AWG wire Bonds	185	123	93

- b. For bond quantities greater than shown above obtain maximum allowable bond resistance from ENGINEER.
  - c. CONTRACTOR shall remove and replace all joint bonds on a joint that exceeds the maximum allowable resistance. Replacement joint bonds shall be retested for compliance with the specified bond resistance.
  - d. Any defective joint bond discovered during SYSTEM TESTS AND INSPECTION shall be located, excavated, repaired, and backfilled by CONTRACTOR.
4. Test Records: Records shall be made of each bonded pipeline during the test and submitted to ENGINEER. These records shall include:
  - a. Description and location of the pipeline tested.
  - b. Starting location and direction of test.
  - c. Date of test.
  - d. Joint type.
  - e. Measured joint bond resistance

C. Insulated Joint Isolation Test:

1. CONTRACTOR shall provide a Cathodic Protection Specialist to test each insulating joint after assembly with a GAS Electronics Model 601 insulator tester or equivalent instrument in accordance with the manufacturer's written instructions.
2. The Cathodic Protection Specialist shall conduct additional insulating joint testing as required to insure that insulating flanges are not electrically shorted by other equipment or incidental contact with concrete reinforcement.
3. Conduct test before burial and coating of buried insulating flanges.
4. CONTRACTOR to replace damaged or defective insulation parts identified during testing.
5. Electrical Isolation is defined as a condition of being electrically isolated from other metallic structures (including, but not limited to, other piping, concrete reinforcement, casings, and other structures not intended to be cathodically protected) and the environment as defined in NACE Recommended Practice RP0169-83.
6. CONTRACTOR shall submit a report prepared by the Corrosion Specialist certifying insulating joint testing isolation and any corrective action required.

D. Pump Isolation Test:

1. CONTRACTOR shall provide a Cathodic Protection Specialist to test and certify there is electrical isolation between each of three pump casings and their pump discharge headers.

2. The Cathodic Protection Specialist shall conduct additional insulating joint testing as required to insure that insulating flanges are not electrically shorted by other equipment or incidental contact with concrete reinforcement or electrical grounding.
3. Testing between pump column and discharge header shall be performed as the pump and pump column is installed.
4. CONTRACTOR to replace damaged or defective insulation parts identified during testing.
5. Electrical Isolation is defined as a condition of being electrically isolated from other metallic structures (including, but not limited to, other piping, concrete reinforcement, casings, and other structures not intended to be cathodically protected) and the environment as defined in NACE Recommended Practice RP0169-83.
6. CONTRACTOR shall submit a report prepared by the Cathodic Protection Specialist certifying insulating joint testing isolation and any corrective action required.

### **3.11 SYSTEM TESTS AND INSPECTION**

#### **A. General**

1. CONTRACTOR shall correct all construction defects identified during testing.
2. Provide ENGINEER with one week advance notice before beginning tests.

#### **B. Electrical Continuity Testing:**

1. Preliminary Continuity Test By ENGINEER
  - a. After the pipeline construction is completed and all test stations have been installed, ENGINEER shall test all pipelines with joint bonds for electrical continuity using the four-wire lineal pipe resistance test method.
  - b. Test will be conducted with a minimum test current of 15 amperes using a portable rectifier or dc welder.
  - c. An electrically continuous pipeline will be defined as a pipe or section of pipe that has a linear electrical resistance equal to or less than the sum of the resistance of the pipe plus the maximum allowable joint bond resistance for each joint as specified in this section.
  - d. CONTRACTOR shall locate electrically discontinuous joints at his sole expense as specified herein.
  - e. Each discontinuous section of pipe shall be retested by ENGINEER after all continuity repairs are completed to demonstrate that the pipeline is electrically continuous. ENGINEER retesting costs shall be at the CONTRACTOR's expense.
2. Electrical Discontinuity Location:
  - a. CONTRACTOR shall be solely responsible for location and repair of all discontinuous or high resistance joints bonds using a test method determined by CONTRACTOR. Regardless of test method used to locate discontinuous joints, final acceptance of discontinuous sections shall be determined by the lineal pipe resistance method.
  - b. After all discontinuous or high resistance joint bonds are repaired, the repaired section shall have a resistance less than or equal to the

calculated allowable lineal pipe resistance as determined by the initial final continuity testing.

- c. Existing joint bonds damaged during excavation of the pipe for repairs or temporary wire connections shall be repaired by CONTRACTOR.
- d. Existing test stations shall be protected from damage. When damage occurs CONTRACTOR shall complete repairs while the excavation is open. Undisclosed test station damage that requires repairs to be made after backfilling the excavation will be repaired at CONTRACTOR sole expense.

C. Cathodic Protection System Energizing and Testing:

- 1. After the installation of the cathodic protection system is completed, ENGINEER shall energize and adjust the system and ensure proper installation of the cathodic protection system.
- 2. Test data obtained shall be tabulated and submit in a report of the system operation, test methods, and protection levels. Test data from all testing performed shall be submitted in tabular and electronic form.
- 3. Energizing and Testing procedures shall, as a minimum, include the following:
  - a. Static pipe-to-soil potentials at each test station on each wire in the test station.
  - b. Test station wire continuity at each test station
  - c. Final electrical continuity of pipeline between each test station.
  - d. 'ON' pipe-to-soil potentials at each test station
  - e. Anode current output at each anode test station
  - f. Interference potentials at all crossing metallic pipelines.
  - g. Polarized 'ON' potentials after four weeks operation, minimum and three months, maximum.
  - h. Verification of electrical isolation of the pipe at each mainline valve vault.
  - i. GPS positions in latitude and longitude format using a WGS 84 datum for all test stations. Locations shall be identified by GPS location, test station type, and street address. Accuracy of GPS positional measurements shall be sub-meter or better.
- 4. As a minimum, data shall indicate location of test box with clear differentiation between readings. Report shall also include name of the Corrosion Specialist who performed the test, manufacturer and model of equipment used, and a description of procedure followed in taking the readings, including the rectifier settings.

- END OF SECTION -

**SECTION 31 05 19**  
**GEOSYNTHETICS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section covers the manufacturing and installation of geosynthetics.

**1.2 RELATED WORK**

- A. Related work specified in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 22 00 Site Grading
3. Section 31 23 15 Excavation and Backfill for Buried Pipelines
4. Section 33 46 16 Sub-Drainage System
5. Section 33 16 00 Underground Water Storage Reservoir

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                     |   |
|---------------------|---|
| 1. B16.1/ASTM D 751 | Standard Test Methods for Coated Fabrics  |
| 2. ASTM D 1777      | Standard Test Method for Thickness of Textile Materials   |
| 3. ASTM D 3786      | Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method |
| 4. ASTM D 4533      | Standard Test Method for Trapezoid Tearing Strength of Geotextiles  |
| 5. ASTM D 4632      | Standard Test Method for Grab Breaking Load and Elongation of Geotextiles                                 |
| 6. ASTM D 4751      | Standard Test Method for Determining Apparent Opening Size of a Geotextile                                |
| 7. ASTM D 4833      | Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products                   |
| 8. ASTM D 5034      | Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)                  |
| 9. ASTM D 5035      | Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)                  |
| 10. ASTM D 5261     | Standard Test Method for Measuring Mass per Unit Area of Geotextiles                                      |

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Quality Control Certificates shall be provided at a minimum frequency of one (1) per every hundred thousand (100,000) square feet of geosynthetics produced consecutively,

and which is supplied to the project. These certificates shall be supplied only for the individual rolls of geosynthetics sampled and tested by the Manufacturer or his representative. An individual Quality Control Certificate shall be provided for each roll of geosynthetics provided to the project, which was not produced consecutively within the hundred thousand (100,000) square foot lot. Quality Control Certificates shall be submitted two (2) weeks prior to installation of geosynthetics and shall state that the geosynthetics meets the requirements of these specifications for:

1. Mass per Unit Area
  2. Grab Tensile Strength
  3. Mullen Burst Strength
  4. Equivalent Opening Size
- C. Geosynthetics shall not be accepted and/or incorporated into the project without the approved quality control documentation.
- D. Certification stating that all geosynthetics is furnished by one manufacturer shall be submitted two (2) weeks prior to installation.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Storage and handling of the geosynthetics shall be the responsibility of CONTRACTOR.
- B. During shipment, handling and storage, the geosynthetics shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, puncture, cutting or any other damage or deleterious conditions. To that effect, geosynthetics rolls shall be shipped and stored in relatively opaque and watertight wrappings. An opaque tarp shall be placed over all rolls where the outer wraps are removed or damaged and where the geotextile is exposed. CONTRACTOR shall be responsible for the replacement of damaged or unacceptable materials at no cost to OWNER.
- C. Storage of Materials: A storage area shall be provided on site by OWNER. The storage of geosynthetic materials shall be the responsibility of CONTRACTOR until the completed installation is accepted by ENGINEER.
- D. Damaged Geosynthetics: Damaged geosynthetic materials shall be repaired, if possible, in accordance with these specifications, or shall be replaced at no additional cost to OWNER.

## **1.6 MEASUREMENT AND PAYMENT**

- A. Geosynthetics shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

## **PART 2 PRODUCTS**

### **2.1 GEOSYNTHETICS (FILTER FABRIC)**

- A. The geosynthetics shall be 10-ounce (or heavier) non-woven filter fabric.
- B. Geosynthetics shall be provided in rolls.



- C. Each roll of geosynthetics shall be externally labeled or tagged to provide product identification sufficient for field determination as well as inventory and quality control purposes. Each roll shall be labeled with the name of manufacturer, roll number, physical dimensions (length and width) and the material type. Any roll of geosynthetics from which the labeling has been removed or has become illegible, shall not be used, but shall be removed from the site and replaced at the expense of CONTRACTOR.
- D. The geosynthetics shall be sampled, tested, and certified by the manufacturer for the following properties:

<b>MATERIAL PROPERTIES FOR NON-WOVEN GEOTEXTILE FILTER FABRIC</b>		
Property	Specification	ASTM Test Method
Mass per Unit Area (min)	10.0 oz./S.Y.	D-5261
Grab Tensile Strength (min)	250 lbs.	D-4632
Elongation at Break	50 %	D-4632
Tear Strength (min)	100 lbs	D-4533
Apparent Opening Size (maximum U.S. Sieve size)	100 mesh	D-4751

- E. Filter Fabric shall be **Mirafi 1100N by TenCate, 250NW by U.S. Fabrics**, or approved equal.

## **PART 3 EXECUTION**

### **3.1 DEPLOYMENT**

- A. Prior to deployment, CONTRACTOR shall inspect each roll of geosynthetics to verify that the roll has a valid Quality Control Certificate and that has been previously approved by ENGINEER.
- B. Adjacent rolls shall be joined by overlapping the edges a minimum of twelve (12) inches.
- C. The overlap shall be glued, sewn or otherwise fastened or secured at intervals no greater than two feet along a line through the midpoint of the overlap. Additional fasteners shall be installed as necessary to prevent slippage of the geosynthetics regardless of location.
- D. CONTRACTOR shall visually inspect the geosynthetics during deployment for holes, tears or improperly formed geosynthetics. Defective areas shall be repaired or removed and replaced by CONTRACTOR at no additional cost to OWNER.
- E. Smoking shall not be permitted on the geosynthetics.
- F. CONTRACTOR shall be responsible to provide adequate loading (e.g., sand bags or similar items that will not damage the underlying geosynthetic) to prevent movement of

the geosynthetics. Any damage to the geosynthetics shall be repaired at CONTRACTOR's expense.

- G. The geosynthetics shall not be exposed to the sun and elements for more than 72 hours unless the filter fabric has ultraviolet inhibitors. Fabric with ultraviolet inhibitors shall not be exposed for a period in excess of the manufacturer's recommendations, in which case manufacturer shall provide prior to product delivery.
- H. Any damage to the geosynthetics during installation or any fabric that has been exposed to the sun or elements for longer than the 72 hours, or as specified by the manufacturer, shall be replaced by CONTRACTOR at no additional cost to OWNER.
- I. CONTRACTOR shall be responsible to observe placement of geosynthetics. CONTRACTOR shall provide a daily inventory of all geosynthetics deployed to ENGINEER.

### **3.2 REPAIRS**

- A. Any holes, tears or defective areas in the geosynthetics shall be repaired by patching with same type of geosynthetics. The patch shall extend a minimum of twelve (12) inches in all directions beyond the area to be repaired. The patch shall be secured in place by gluing, sewing, or securing the fabric as per these specifications.

- END OF SECTION -

**SECTION 31 11 00**  
**CLEARING, GRUBBING, AND STRIPPING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Work shall consist of removing and disposing of all trees; shrubs; brush; stumps; windfalls; roots; and other vegetation, including dead and decayed matter; and debris that exist within the designated construction limits, borrow areas, and soil stockpile areas and which are not specifically designated to remain.

**1.2 DEFINITIONS**

- A. Clearing: Clearing operations shall consist of cutting, removing and disposing of trees, shrubs, bushes, windfalls and other vegetation within the construction limits, borrow areas, and soil stockpile areas. All brush shall be cut off within six inches of the ground surface.
- B. Grubbing: Grubbing operations shall consist of removing and disposing of stumps, roots, debris deleterious materials, and other remains (such as organic and metallic materials) which if left in place would interfere with proper performance or completion of the contemplated work, would impair its subsequent use or form obstructions therein. Organic material from clearing or grubbing operations shall not be incorporated in fill or backfill.
- C. Stripping: Stripping operations shall consist of removing all soil material containing sod, grass, or other vegetation and topsoil to a minimum depth of six (6) inches from all areas that will receive fill or over all trenches in field or yard areas.

**1.3 MEASUREMENT AND PAYMENT**

- A. Measurement and payment for clearing, grubbing and stripping shall not be paid as a unit item, but considered as included in the contract unit or lump sum prices for the various items of the contract to which it relates.

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION**

**3.1 CLEARING**

- A. All trees, stumps, shrubs, bushes, windfalls and other vegetation (except such trees and vegetation as may be indicated or directed by ENGINEER to be left standing) shall be cut off to within six inches of the ground surface and shall be removed from the construction limits. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by such means as the circumstances require.

**3.2 GRUBBING**

- A. All stumps, roots, debris, deleterious and other organic or metallic materials not suitable for foundations shall be removed completely from the construction limits, borrow areas

and soil stockpile areas. Unless otherwise permitted by ENGINEER, stumps shall be removed completely. If any stumps are permitted to remain, they shall be cut off not more than six inches above the ground.

### **3.3 STRIPPING**

- A. Soil material containing sod, grass, or other vegetation and topsoil shall be removed to a minimum depth of six (6) inches from all areas to receive fill from the area within lines 5 feet outside all foundation walls, over all trenches, and from beneath pavement and curb and gutter areas. Place and compact stripped material at east 2:1 slope of pump station property, see plans, or in other locations acceptable to ENGINEER. Topsoil shall be placed over areas which may be landscaped in future (outside of paved areas).

### **3.4 DISPOSAL**

- A. Open burning of combustible materials will be not allowed.
- B. All trees, timber, stumps, roots, debris, shrubs, bushes, and other vegetation removed during the clearing and grubbing operations shall be removed from the project site and disposed of by CONTRACTOR subject to specific regulations imposed by laws and ordinances and in a manner that will not create a public nuisance nor result in unsightly conditions. CONTRACTOR shall assume full responsibility for acceptable disposition of the material as well as for any damages resulting from his disposal operations.

- END OF SECTION -

**SECTION 31 22 00**  
**SITE GRADING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Work consists of site grading and related activities.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
1. Section 01 45 00 Quality Control and Materials Testing
  2. Section 01 50 00 Temporary Construction Utilities & Environmental Controls
  3. Section 31 23 15 Excavation and Backfill for Buried Pipelines
  4. Section 31 23 23 Excavation and Backfill for Structures
  5. Section 32 11 23 Untreated Base Course

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of these Specifications to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>)
  2. ASTM D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

**1.4 MEASUREMENT AND PAYMENT**

- A. Site grading shall not be paid as a separate item but shall be paid as part of the items to which it relates.

**PART 2 PRODUCTS**

**2.1 EMBANKMENT MATERIAL**

- A. Embankment materials are defined as those complying with ASTM D2487, the Unified Soil Classification System (USCS) of CL, ML, SM, SC, SP, or combinations of these materials.
- B. Embankment material shall be free from frozen lumps, rocks larger than 6 inches in the larger dimension, roots, trash, lumber, or organic material. Suitability of material for embankment in accordance with these criteria will be as determined by ENGINEER.
- C. Use of on-site soils as embankment material in fills. Outside the perimeter of those fills which must be structural fill material (i.e. outside the 1:1 sloped fill lines which support the pump station and generator pad footings and slab), fills may be excavated on-site soils if it meets fill compaction requirements.

- D. See Specification Section 31 23 23 for excavation and structural fill requirements within the 1:1 sloped fill lines which support the pump station and generator pad footings and slab.
- E. It is anticipated that CONTRACTOR may choose to furnish additional quantities of embankment fill material from off-site sources to supplement material available from on-site excavations. CONTRACTOR shall not borrow materials from adjacent private or public lands without providing to OWNER written verification of such approval from the appropriate landowner or agency. CONTRACTOR shall be responsible for all costs associated with providing additional quantities of embankment fill as may be required to complete the work described herein and as shown on the Contract Drawings.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Grading shall produce uniform grades or slopes between spot elevations or contours shown.
- B. Areas of construction activity shall be left in condition of uniform grade, blending into pre-existing contours and concealing, as much as possible, evidence of construction activity by back dragging or raking to conceal tire marks. Revegetation shall not be performed until the subgrade is acceptable to OWNER.
- C. Unless otherwise directed by OWNER, all excess excavated materials shall be removed from the site and disposed of by CONTRACTOR. CONTRACTOR shall restore stockpile area to pre-existing condition.

### **3.2 SITE PREPARATION**

- A. Prior to placement of embankment fill, loose, or disturbed soil, shall be removed and replaced with compacted structural fill, or disturbed soil shall be properly compacted.
- B. Prior to placement of embankment fill, the top 6-inches, or as noted on the Contract Drawings, of the subgrade shall be scarified and compacted to 90% minimum Modified Proctor density as determined by ASTM D1557.
- C. Embankment shall include the placement of materials to raise the existing grade to the established elevations indicated and the construction of driving surfaces.
- D. Embankment material shall be placed in no more than 8-inch loose lifts for heavy equipment, and 4-inch loose lifts for hand operated equipment.
- E. All embankment fill material shall be placed and compacted to 95% minimum Modified Proctor Density as determined by ASTM D1557.
- F. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and recompacted to the minimum required compaction.
- G. Unless otherwise specified, CONTRACTOR shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications.

If the Soils Testing Agency should determine that CONTRACTOR is failing to meet the minimum requirements, CONTRACTOR shall stop operations and make adjustments as necessary to produce a satisfactorily compacted fill at no additional cost to OWNER.

### **3.3 GRADING**

- A. The final grade of all completed areas shall be between plus and minus one-tenth ( $\pm 0.1$ ) of a foot from the grade designated on the Contract Drawings.

- END OF SECTION -

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**SECTION 31 23 15**  
**EXCAVATION AND BACKFILL FOR BURIED PIPELINES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This item shall consist of excavating all pipeline trenches to the lines and grades indicated on the Contract Drawings or as directed by ENGINEER in the field, and the backfilling of all pipeline trenches. Excavation shall include the removal of all materials of whatever nature encountered to the depths shown on the Contract Drawings, or as modified in the Field by ENGINEER.

**1.2 RELATED SECTIONS**

- A. Related Work specified in other Sections includes, but is not limited to:
1. Section 01 33 00 Submittal Procedures
  2. Section 01 45 00 Quality Control & Materials Testing
  3. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
  4. Section 31 23 19 Dewatering
  5. Section 33 05 05 Ductile Iron Pipe
  6. Section 33 92 10 Steel Pipe, Specials, and Fittings

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referred. The publications are referred to in the text by basic designation only.
- B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
1. M 145 Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
  2. T 27 Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
  3. T 88 Standard Method of Test for Particle Size Analysis of Soils
  4. T 96 Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  5. T 180 Standard Method of Test for Moisture Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in (457 mm) Drop
  6. T 191 Standard Method of Test for Density of Soil In Place by the Sand Cone Method
  7. T 205 Density of Soil In-Place by the Rubber-Balloon Method
  8. T 238 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
  9. T 239 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
  10. T 310 Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
2. C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
3. D 422 Standard Test Method for Particle Size Analysis of Soils
4. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup>)
5. D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone method
6. D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft<sup>3</sup>)
7. D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity -Flow Applications
8. D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
9. D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

#### 1.4 DEFINITIONS

- A. Degree of Compaction: Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.
- B. Pipe Zone: That zone in an Excavation which supports, surrounds, and extends to 12 inches above the top of the pipe barrel. Specifically, 6 inches below the bottom (where rock, hard pan, boulders, etc. are encountered), 12 inches above the top of the pipe, and 1 foot laterally beyond both sides of the pipe, unless noted otherwise on the Contract Drawings.
- C. Trench Zone Backfill: That zone in an Excavation which begins 12 inches above the top of the pipe barrel and extends to the natural surface level or the finished grade indicated on the Plans.
- D. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 12 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.
- E. Unstable Material: Unstable material shall consist of materials too wet to allow backfill compaction or to properly support the utility pipe, conduit, or appurtenant structures.
- F. Rock: Solid mineral material which cannot be removed with equipment reasonably expected to be used in the Work without cutting, drilling or blasting. Minimum equipment size, in good running order, shall be similar to a **Komatsu 300, Caterpillar 320 or 330**, or equal.

#### 1.5 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01 33 00 - Submittal Procedures:
  1. Copies of Field Density Test reports shall be submitted to ENGINEER at the beginning of each workday for the previous day's testing of subgrades, embankments and backfill Materials.

2. Copies of all Laboratory Test Reports shall be submitted to ENGINEER within 24 hours of the completion of the test.
3. Submit gradations and proctors for Pipe Zone Material and Trench Zone Backfill.
4. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

## 1.6 SITE CONDITIONS

- A. Unsuitable Weather Limitations: CONTRACTOR shall not place, spread, or roll any fill material during unsuitable weather conditions. CONTRACTOR shall not resume operations until moisture content of material is satisfactory.
- B. Weather Softened Subgrade: CONTRACTOR shall remove and replace at no additional cost to OWNER soft subgrade materials resulting from adverse weather conditions.
- C. Protection of Graded Areas: CONTRACTOR shall protect all graded areas from traffic and erosion and shall keep these areas free of trash and debris. Work required to repair and reestablish grades in settled, eroded, and rutted areas shall be completed to specified tolerances at CONTRACTOR's expense.
- D. Reconditioning Compacted Areas: All areas compacted to required specifications that become disturbed by subsequent construction operations or weather conditions shall be scarified, moisture conditioned, and re-compacted to the required density prior to further construction.
- E. Grading: the final compacted surface of base course shall not vary more than 1/4 inch above or below design grade.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Stabilization Material: Stabilization material shall consist of hard, durable particles of stone or gravel, screened or crushed to the required size and gradation. The material shall be free from vegetation matter, lumps or balls of clay, or other deleterious matter and shall conform to the following gradation when tested in accordance with AASHTO T 27 or ASTM C 136.
  1. Coarse material shall be crushed or washed and fine material shall be wasted to meet the grading requirements set forth below. Note that if stabilization material is required, an 8 oz. non-woven filter fabric shall be placed between the stabilization material and the pipe zone material.
  2. Coarse aggregate, retained on the No. 4 sieve, shall have a percentage of wear not greater than 40 percent when tested by the Los Angeles Test, AASHTO T-96 or ASTM C 131.

Sieve Size (Square Opening)	Percent By Weight Passing Screen
2-inch	100
1-1/2 inch	10 - 50

3/4-inch	0 - 25
No. 4	0 - 10
No. 200	0 - 3

- B. Pipe Zone Material: All material in the pipe zone shall be clean and free from alkali, salt, petroleum products, vegetative matter or other deleterious matter, slag, cinders, ashes and rubbish or other material that in the opinion of ENGINEER may be objectionable or deleterious. "Squeegee" or any other flowable material shall not be permitted. Pipe zone material shall conform to the following:

1. Storm Drain – Gravel, 100 percent crushed mineral aggregate per the following gradation:

U.S. Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
1 1/2 - inch	100
1 - inch	95-100
1/2 - inch	25-60
No. 4	0-10
No. 200	0-5

2. Waterline – Sand per the following gradation:

U.S. Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
1/2 - inch	100
No. 10	30-60
No. 40	0-30
No. 200	0-15

3. Waterline – Controlled Low-Strength Material (Flowable Fill):

- a. Flowable Fill shall be per APWA Section 03 31 05 – Controlled Low Strength Material. Contractor shall submit a CLSM material – which is sand-cement-flyash slurry mix that has between 50 to 150 psi strength at 28 days. Submit any proposed admixtures.

- C. Select Trench Backfill: When pipes are below structures (and below 1:1 sloped planes supporting footings), Trench Zone Backfill must be Structural Fill Material.

- D. Native Trench Backfill: Do not use native on-site soil for trench backfill.

- E. Imported Granular Trench Backfill: Use non-plastic imported granular trench backfill meeting soils classifications A-1, A-2 or A-3 (A-1-a for Granular Borrow material) of AASHTO M 145 with max particle size under 6 inches and meet a 95% compaction requirement.

## **PART 3 EXECUTION**

### **3.1 EXCAVATION**

- A. Excavation shall be performed to the lines and grades indicated. All excavated materials not intended for reuse shall be removed from the site and disposed of by the Contractor.
- B. Rock Removal
  - 1. CONTRACTOR shall cut away Rock at excavation bottom to form level bearing.
  - 2. All shaled layers shall be removed to provide sound and unshattered base for foundations.
  - 3. CONTRACTOR shall remove and legally dispose of excess excavated material and debris off-site unless indicated otherwise.
  - 4. CONTRACTOR shall correct unauthorized Rock removal at no additional cost to OWNER.

### **3.2 SAFETY**

- A. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the latest requirements of OSHA Safety and Health Standards for Construction (29 CFR 1926). CONTRACTOR is responsible for assessing safety needs to meet such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods, and construction practices so as to fully comply with all safety requirements.
- B. CONTRACTOR is responsible for assessing needs related to confined space entry, as defined by OSHA. CONTRACTOR shall meet all such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods, and construction practices so as to fully comply with all confined space safety requirements.

### **3.3 DEWATERING**

- A. Water removal shall be in accordance with Section 31 23 19 - Dewatering.

### **3.4 TRENCH WIDTH**

- A. The bottom of the trench shall have a minimum width equal to the outside diameter of the pipe plus 24-inches or as detailed on the Contract Drawings.
- B. The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed and compacted as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting, and bracing, and the handling of special units as necessary.

### **3.5 TRENCH PREPARATION**

- A. Each trench shall be excavated so that the pipe can be laid to the alignment and grade as required. The trench wall shall be so braced that the workmen may work safely and efficiently. All trenches shall be drained so the pipe laying may take place in dewatered conditions.
- B. Bottom Preparation
  - 1. Where rock, hard pan, boulders or other material which might damage the pipe are encountered, the bottom of the trench shall be over excavated 4 inches below the required grade and replaced with Stabilization Material. Otherwise, the bottom of the trench shall be over excavated 6 inches or 1/12 the outside diameter of the pipe, whichever is greater, below the required grade and replaced with Pipe Zone Backfill.
  - 2. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1-inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.
- C. Removal of Unstable Material
  - 1. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed by ENGINEER and replaced to the proper grade with Stabilization Material. When removal of unstable material is required due to the fault or neglect of CONTRACTOR in his performance of the work, the resulting material shall be excavated and replaced by CONTRACTOR without additional cost to OWNER.
- D. The trench bottom (at the level of the base of the pipe) shall be given a final trim using a string line, laser, or another method approved by ENGINEER for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Bell holes shall be provided at each joint to permit the jointing to be made properly. The trench grade shall permit the pipe spigot to be accurately centered in the preceding laid pipe joint, without lifting the pipe above the grade, and without exceeding the permissible joint deflection.

### **3.6 SHEETING AND SHORING**

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support trenches excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Design sheeting and shoring to be removed at completion of excavation work.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

### **3.7 LAYING AND JOINING PIPE**

- A. Laying pipe: Provide proper facilities for lowering pipe sections into place. Dropping pipe will not be permitted. Place each section true to line and gradient in close and true contact with adjacent sections.
- B. Joining pipe:
  - 1. Use methods of joining conduit sections ensuring ends are fully entered and inner surfaces are flush and even. The equipment used to force the joints together must be adequate to overcome the gasket pressure involved. Pipe shall be installed in accordance with these specifications and the manufacturers written specifications.
  - 2. Just prior to joining the pipes, both spigot and bell ends shall be thoroughly cleaned to remove all foreign substances which may have adhered to the bell and spigot surfaces. All dust and dirt shall be removed with a clean rag. An approved lubricant (recommended by the manufacturer), that is not injurious to the gasket, shall be applied in accordance with the manufacturer's recommendations.
  - 3. In the event any foreign material becomes embedded in the lubricant, or the lubricant becomes contaminated by water or other substances before the joint is started, the area affected shall be re-cleaned and new lubricant applied.
  - 4. The pipe being joined shall be carefully moved into position, line and grade checked, and, as the spigot end is started into the bell of the section previously laid, the gasket shall be checked to insure uniform entry into the bell at all points. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Apply firm steady pressure either by hand or by bar and block assembly, until the spigot easily slips through the gasket. Care must be taken to ensure that the spigot is not over-inserted and that previously assembled pipe joints are not disturbed.

### **3.8 PIPELINE TRENCH BACKFILLING AND COMPACTION**

- A. Pipe Zone:
  - 1. Pipe Zone Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise approved or specified. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be compacted to at least 95 percent of the maximum Modified Proctor dry density (ASTM D-1557), unless otherwise specified.
  - 2. Replacement of Unyielding Material: Unyielding material removed from the bottom of the trench shall be replaced with Stabilization Material placed in layers not exceeding 6 inches loose thickness.
  - 3. Replacement of Unstable Material: Unstable material removed from the bottom of the trench or excavation shall be replaced with Stabilization Material placed in layers not exceeding 6 inches loose thickness.
  - 4. Where the pipe grade exceeds 30%, cohesive material shall be used in lieu of pipe bedding. The cohesive material shall be moistened to within 2% of optimum moisture and compacted as noted.
  - 5. The relative density of the compacted cohesionless material shall not be less than 60% as determined by the Bureau of Reclamation Relative Density of Cohesionless Soil Test (Designation E-12) of the "Earth Manual."

B. Trench Backfill: Trenches shall be backfilled to the grade shown with Trench Zone Backfill material as specified.

1. Trench backfill in asphalted road shall consist of backfilling the trench from above the pipe zone up to underneath the noted recommended depth for untreated base course and asphalt or concrete of finished grade with Trench Backfill material compacted to 95 percent of maximum dry density (ASTM D-1557). Backfill shall be placed in layers not exceeding 6-inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise approved or specified.
2. Trench backfill in unimproved or landscaped areas shall consist of backfilling the trench from above the pipe zone to 8-inches below finished grade with Trench Backfill material compacted to 95 percent of maximum dry density (ASTM D-1557). Backfill from 8-inches below finished grade to finished grade shall consist of topsoil replacement in addition to replacement of all landscaped materials. Trench backfill shall be placed in layers not exceeding 8 inches loose thickness.
3. It shall be the responsibility of CONTRACTOR to be assured that the Trench Backfill material is capable of being compacted to the degree specified. It shall be CONTRACTOR's responsibility to remove and dispose of all excess excavated material.

C. Final Backfill:

1. Unimproved and Landscaped Areas: The top 8-inches of the trench shall be filled with topsoil. Topsoil may be native on-site material stripped prior to excavation of the trench. Backfill shall be deposited in layers of a maximum of 12-inch loose thickness and compacted to a minimum of 85 percent maximum dry density (ASTM D-1557). Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.
2. Roadways shall be completed with the type and thickness of materials (i.e., Untreated Road Base and Asphalt) as indicated or shown on the Contract Drawings

### **3.9 SPECIAL REQUIREMENTS**

A. Special requirements for both excavation and backfill relating to the specific utilities from above the pipe zone to the natural surface level or the finished grade indicated on the Plans shall be placed and compacted as follows:

1. Where existing underground pipes or conduits larger than 3 inches in diameter and all sizes of sewer lines or sewer laterals cross the trench above the new work, the backfill from the bottom of the trench to 1 foot above the top of the intersecting pipe or conduit shall be pipe zone material compacted to 95 percent of maximum dry density (ASTM D-1557). The pipe zone material shall extend 2 feet on either side of the intersecting pipe or conduit to ensure that the material will remain in place while other backfill is placed.

B. The maximum trench length open at any given time shall not exceed 200 feet unless approved by ENGINEER and must be backfilled in a timely manner.



### **3.10 MAINTENANCE OF BACKFILL**

- A. All backfill shall be maintained in satisfactory condition, and all places showing signs of settlement shall be filled and maintained during the life of the Contract and for a period of one year following the day of final acceptance of all work performed under the Contract. When CONTRACTOR is notified by ENGINEER or OWNER that any backfill is hazardous, CONTRACTOR shall correct such hazardous condition at once. Any utility, road and/or parking surfacing damaged by such settlement shall be repaired by CONTRACTOR to the satisfaction of OWNER and ENGINEER. In addition, CONTRACTOR shall be responsible for the cost to OWNER of all claims for damage filed with the Court, actions brought against the said OWNER for, and on account of, such damage.

### **3.11 FINISH GRADING AND CLEANUP**

- A. CONTRACTOR shall grade the trench line to a smooth grade to affect a neat and workmanlike appearance of the trench line.
- B. All tools, equipment and temporary structures shall be removed. All excess dirt and rubbish shall be removed from the site by CONTRACTOR.
- C. CONTRACTOR shall restore the site to at least as good as original condition, including but not limited to final trench grade and restoration of affected public and private facilities whether in the public right-of-way or on private property. Any exception to this requirement must be in writing from ENGINEER for the job specific conditions.

### **3.12 COMPACTION TESTS**

- A. It shall be the responsibility of CONTRACTOR to accomplish the specified compaction for backfill, fill, and other earthwork. It shall be the responsibility of CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.
  - 1. Testing of Backfill Materials
    - a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 01 45 00 - Quality Control & Materials Testing.
    - b. The CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
      - i) 50 linear feet of trench backfill.
    - c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
    - d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.
    - e. Compliance tests may be made by ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to CONTRACTOR.
    - f. ENGINEER may require retesting of backfill that has settled from water penetration in the trench. CONTRACTOR shall remove the overburden above

the level at which ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete at no additional cost to the OWNER.

- g. If compaction fails to meet the specified requirements, CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by CONTRACTOR. CONTRACTOR's confirmation tests shall be performed in a manner acceptable to ENGINEER

## 2. Field Density Tests

- a. Field density tests shall be made in accordance with ASTM D 1557.

- END OF SECTION -

**SECTION 31 23 19**  
**DEWATERING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Section provides specifications for dewatering systems and appurtenances to be used during construction as required to remove water and continuously maintain groundwater at a level at least 1-foot below the bottom of the excavation.
- B. CONTRACTOR shall obtain all necessary permits for disposal of water removed from the excavation.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures

**1.3 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Before dewatering is commenced, CONTRACTOR shall provide information to ENGINEER outlining the method, installation and details of the proposed dewatering system. CONTRACTOR shall provide ENGINEER with plans setting forth details of the proposed dewatering systems. The dewatering system plans shall be of sufficient detail to indicate sizes of pumps, piping, appurtenances, the ultimate disposal point for water, and to indicate the overall completeness and effectiveness of the proposed system.
- C. CONTRACTOR shall certify to OWNER that the design and implementation of the proposed dewatering system is sufficient to complete the Work.
- D. Submit a plan to monitoring settlement of adjacent structures.

**1.4 QUALITY CONTROL**

- A. CONTRACTOR shall be responsible to control the rate and effect of dewatering to avoid all settlement and subsidence.
- B. Where critical structures exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop. CONTRACTOR is responsible for protecting adjacent structures from settlement. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of CONTRACTOR.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. CONTRACTOR shall be responsible for selection of dewatering means, methods and materials.

- B. Standby pumping equipment shall be maintained on the Site.

## **PART 3 EXECUTION**

### **3.1 DESIGN AND IMPLEMENTATION**

- A. CONTRACTOR shall be responsible for complete design and implementation of the dewatering system.
- B. CONTRACTOR shall be responsible for the design and implementation of any modifications that may be required to the initial design of the dewatering system (at no additional cost to OWNER) to provide a dewatering system that operates adequately to complete the Work.
- C. CONTRACTOR shall furnish, install, operate and maintain all machinery, appliances, and equipment to maintain all excavations free from water during construction.
- D. CONTRACTOR shall dispose of water so as to not cause damage to public or private property, or to cause a nuisance or menace to the public or violate the law.
- E. CONTRACTOR shall be responsible to obtain groundwater discharge permits, if required.
- F. CONTRACTOR shall install and operate the dewatering system so as to not cause damage or endanger adjacent structures or property.
- G. The control of groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils," does not occur. Dewatering systems shall be designed and operated so as to prevent removal and migration of the natural soils.
- H. CONTRACTOR shall have sufficient stand-by equipment at the project site at all times to continuously maintain the dewatering program until Work necessitating dewatering is complete.
- I. CONTRACTOR shall have on hand equipment and machinery in good working condition for emergencies and shall have personnel available for operation of such equipment and machinery.
- J. CONTRACTOR shall control surface water to prevent entry into excavations.

- END OF SECTION -

**SECTION 31 23 23**  
**EXCAVATION AND BACKFILL FOR STRUCTURES**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section covers excavating, backfilling, and compacting of disturbed areas for structures and roadways as directed by ENGINEER.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
1. Section 01 33 00 Submittal Procedures
  2. Section 01 45 00 Quality Control and Materials Testing
  3. Section 01 45 23 Testing Agency Services
  4. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
  5. Section 31 11 00 Clearing, Grubbing and Stripping
  6. Section 31 23 15 Excavation and Backfill for Buried Pipelines
  7. Section 31 23 19 Dewatering

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referred. The publications are referred to in the text by basic designation only.
- B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
1. M 145 Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
  2. T 27 Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
  3. T 88 Standard Method of Test for Particle Size Analysis of Soils
  4. T 180 Standard Method of Test for Moisture Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in (457 mm) Drop
  5. T 191 Standard Method of Test for Density of Soil In Place by the Sand Cone Method
  6. T 310 Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. D 422 Standard Test Method for Particle Size Analysis of Soils
  2. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup>)
  3. D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone method
  4. D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft<sup>3</sup>)
  5. D 2487 Standard Practice for Classification of Soils for Engineering Purposes

- (Unified Soil Classification System)
6. D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

- D. The latest Edition of the Utah Department of Transportation Standard Specification for Road and Bridge Construction.
- E. The latest Edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

#### **1.4 SUBMITTALS**

- A. The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures:
1. Submit gradations and proctors for structural fill materials and each backfill material used.

#### **1.5 REMOVE NATIVE MATERIAL AND REPLACE WITH STRUCTURAL FILL TO SUPPORT PUMP STATION AND FOOTINGS**

- A. The top 11 to 14 feet of native material (on-site soil), is predominantly clay, which the Geotechnical Investigations Report indicates may collapse when wetted. This material must be removed beneath the pump station and generator pad. ENGINEER requires it to be replaced with a compacted structural fill having minimum dimensions as stated below and as shown on the Contract Drawings.

### **PART 2 PRODUCTS**

#### **2.1 WALL BACKFILL MATERIAL**

- A. Wall backfill material may be used to refill the excavation around pump station after structural backfill material supporting pump station and generator pad is placed. Wall backfill material shall be either recompact on-site soil or imported fill meeting the following requirements:
1. Recompact on-site soil must be properly moisture conditioned to meet specified compaction requirements.
  2. Imported fill material may be used if it meets soils classifications A-1, A-2 or A-3 of AASHTO M 145, with a maximum particle size no greater than 6 inches in any dimension and meeting all compaction requirements. Structural Fill may be used as Wall Backfill.
- B. Wall Backfill shall be free from frozen lumps, rocks larger than 6 inches in the largest dimension, roots, trash, concrete, lumber, organic material, and other deleterious materials.

#### **2.2 STRUCTURAL FILL**

- A. Structural fill material shall be imported, non-expansive, granular soil with less than 35 percent passing the No. 200 sieve, with a liquid limit less than 30, and free from rocks larger than 4 inches in the largest dimension, frozen lumps, roots, trash, lumber, and organic material.

## **2.3 BELOW FLOOR SLAB FILL**

- A. Use Structural Fill below floor slab(except upper 4 inches) and sidewalks (except upper 6 inches).

## **2.4 FLOOR SLAB FILL (UPPER 4 INCHES)**

- A. Material shall be non-expansive granular soil (sand or gravel) with less than 5 percent passing the No. 200 sieve, and free from rocks larger than 2 inches in the largest dimension, frozen lumps, roots, trash, lumber, and organic material.

## **2.5 SIDEWALK CONCETE SLAB FILL (UPPER 6 INCHES)**

- A. The upper 6 inches below the sidewalk slab shall be untreated base course per Section 32 11 23 - Road Base - Untreated Base Course.

## **2.6 3/4" WASHED ROCK**

- A. 3/4" Washed Rock shall consist of hard, durable particles of stone or gravel, screened or crushed, to the required size and gradation. The material shall be free from vegetation matter, lumps or balls of clay, or other deleterious matter and shall conform to the following gradation when tested in accordance with AASHTO T 27 or ASTM C 136.

<u>Sieve Size (Square Opening)</u>	<u>Percent By Weight Passing Screen</u>
3/4-inch	100
3/8 inch	78-92
No. 4	0 - 50
No. 8	0 - 5
No. 200	0 - 3

## **PART 3 EXECUTION**

### **3.1 EXCAVATION**

- A. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.
- B. Excavations shall be braced and supported as needed to prevent the ground adjacent to the excavation from sliding or settling. Slides shall be promptly removed and corrected by CONTRACTOR.

### **3.2 PREPARATION**

- A. Compact subgrade to density requirements for subsequent per grading spec.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular fill and compact to density equal to or greater than requirements for subsequent fill material.

- C. Pump Station Building and Generator Pad subgrade shall be prepared by removing approximately 13 feet native earth (collapsible clays) down to a suitable clay layer (which layer is field determined by Geotechnical Engineer), and then constructing a structural fill to support the pump station and generator pad as shown in the Contract Drawings and described in the Specifications.
- D. Subgrade below asphalt pavement shall be prepared by removing native earth to subgrade, compacting native subgrade to 90% relative compaction, before placing base and asphalt.
- E. Geotechnical Engineer shall observe the subgrade conditions after the +/-13 foot over-excavation (i.e. suitable clay is exposed in bottom of excavation,) and verify native unsuitable clays have been adequately removed before CONTRACTOR may start backfilling with Structural Fill.

### **3.3 DEWATERING**

- A. Water removal shall be in accordance with Section 31 23 19 - Dewatering.

### **3.4 BACKFILL**

- A. Backfill material shall not be placed against concrete structures that have not been properly cured. No backfill material shall be placed until concrete has cured for a minimum of 7 days or until the compressible strength is 3,400 psi, whichever is greater.
- B. Backfill material shall be placed in no more than 6-inch loose lifts for compaction by hand operated machine compactors, and 8 inches loose lifts for other than hand operated machines.
- C. Structural fill placed beneath foundations, footings or the floor slab shall be placed and compacted to at least 95% of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D 1557.
- D. Backfill material shall be placed and compacted to at least 95 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.
- E. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and re-compacted to the minimum required compaction prior to placing any additional fill material.
- F. CONTRACTOR shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications. If it is determined that CONTRACTOR is failing to meet the minimum requirements, CONTRACTOR shall stop operations and make adjustments as necessary to produce a satisfactorily compacted fill at no additional cost to OWNER.
- G. Sufficient personnel, equipment, sumps, or other means should be provided to maintain the site in an acceptable dry condition for the duration of this contract.



- H. Excavations shall be so braced and supported as needed to prevent the ground, adjacent to the excavation, from sliding or settling. Localized slides or settlements shall be promptly removed and corrected by CONTRACTOR.

### **3.5 USE OF ON-SITE SOIL (CLAYS) AS BACKFILL**

- A. On-site Soil may be used to backfill the 11 to 14 ft deep over excavation volume except where structural backfill material is required (to support pump station and the generator pad). On-Site Soil may also be used to construct the finished grading (fills) shown on the Contract Drawings.
- B. For on-site soil fills supporting asphalt pavements and concrete walks and curbs, compact on-site soil fills to at least 95% maximum dry density per ASTM D 1557. For on-site soil fills NOT supporting pavements and concrete walks and curbs, compact to at least 90% maximum dry density per ASTM D 1557 to the finished grades shown on the Contract Drawings – adjusting for surface materials (i.e., surface rock, topsoil).

### **3.6 FINISHED GRADE**

- A. The finished subgrade and grade of the fill shall not vary more than 0.05 feet from the established grades and cross sections shown on the Contract Drawings.

### **3.7 COMPACTION TESTS**

- A. Compaction testing shall be the provided and paid for in accordance with Section 01 45 00 – Quality Control and Materials Testing.
- B. It shall be the responsibility of CONTRACTOR to accomplish the specified compaction for backfill, structural fill, Untreated Base Course, and other earthwork. It shall be the responsibility of CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

#### **1. Testing of Backfill Materials**

- a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 01 45 00.
- b. Contractor shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
  - 1) Two (2) tests per 1.0 feet of backfill thickness placed per structure.
- c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
- d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.
- e. Quality assurance tests may be made by ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to CONTRACTOR. If

ENGINEER requires retesting of backfill, CONTRACTOR shall remove the overburden above the level at which ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete at no additional cost to OWNER.

- f. If compaction fails to meet the specified requirements, CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid in accordance with Section 01 45 23 – Testing Agency Services. The confirmation tests shall be performed in a manner acceptable to ENGINEER. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

## 2. Field Density Tests

- a. Tests shall be performed in sufficient numbers to meet the requirements of Section 01 45 00 and to ensure that the specified density is being obtained.

C. Field density tests shall be made in accordance with ASTM D1557 and ASTM D6938.

- END OF SECTION -

**SECTION 32 11 23**  
**ROAD BASE - UNTREATED BASE COURSE**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This Work consists of the placement of Sub-Base and Untreated Base Course (UBC) material at designated roadways and all driving surfaces as indicated on the Contract Drawings.

**1.2 RELATED SECTIONS**

- A. Related Work specified in other Sections includes, but is not limited to:
1. Section 01 33 00 Submittal Procedures
  2. Section 01 45 00 Quality Control and Materials Testing

**1.3 REFERENCES**

- A. The latest edition of the following publication forms a part of this Specification to the extent referenced. The publication is referred to in the text by basic designation only.
- B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
1. AASHTO T 88 Standard Method of Test for Particle Size Analysis of Soils
  2. AASHTO T 180 Standard Method of Test for Moisture Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in (457 mm) Drop
  3. AASHTO T 191 Standard Method of Test for Density of Soil In-Place by the Sand Cone Method
  4. AASHTO T 310 Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods. (Shallow Depth)
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM D 422 Standard Method for Particle Size Analysis of Soils
  2. ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)
  3. ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone method
  4. ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>)
  5. ASTM D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
  6. ASTM D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- D. The latest edition of the Utah Department of Transportation Standard Specification for Road and Bridge Construction (UDOT).

## 1.4 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Untreated Base Course (State approved 1-1/2" gradation,.

## 1.5 MEASUREMENT AND PAYMENT

- A. Road Base shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Untreated Base Course: Untreated Base Course Materials shall meet the APWA Specifications for Grade 1 or Grade 3/4 as shown in Table 32 11 23-1 and shall meet A-1-a soil classification (ASHTO M145 or ASTM D3282). Recycled concrete will not be allowed.

**TABLE 32 11 23-1**

<b>SIEVE SIZE</b>	<b>MASTER GRADING BAND LIMITS (PERCENT PASSING)</b>	<b>GRADE 1 GRADATION (PERCENT PASSING)</b>	<b>GRADE 3/4 GRADATION (PERCENT PASSING)</b>
1 1/2 inch	100	-	-
1 inch	90-100	100	-
3/4 inch	70-85	-	100
1/2 inch	65-80	79 - 91	-
3/8 inch	55-75	-	78 - 92
No. 4	40-65	49 - 61	55 - 67
No. 16	25-40	27 - 35	28 - 38
No. 200	7-11	7 - 11	7 - 11

## PART 3 EXECUTION

### 3.1 SUBGRADE PREPARATION

- A. Prior to placement of untreated base course materials, the foundation area to receive untreated base course materials shall be scarified to a minimum depth of 8-inches and recompact to 95% minimum laboratory density as determined by ASTM D1557.

### 3.2 UNTREATED BASE COURSE MATERIAL PLACEMENT

- A. No Untreated Base Course material shall be placed on sub-grade materials until the sub-grade has been checked and accepted by ENGINEER.

- B. Road base material placed on driving surfaces shall be compacted to a minimum density of 96% in accordance with ASTM D1557 to provide a uniform graded smooth surface.
- C. Untreated Base Course material shall be placed to a minimum thickness eight (8) inches or as shown on the Contract Drawings.

### **3.3 FIELD QUALITY CONTROL**

- A. CONTRACTOR shall be responsible for directing proper placement of all road base materials. CONTRACTOR shall be responsible for the stability of the road base materials during placement and shall replace any portions which have become displaced due to careless or negligent work on the part of CONTRACTOR, or to damage resulting from natural causes, such as storms.
- B. Whenever the work areas to receive Sub-Base and/or Untreated Base Course material are covered with snow, the snow must be removed prior to placing the road base and/or Untreated Base Course and deposited outside the immediate construction areas at CONTRACTOR's expense.

- END OF SECTION -

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**SECTION 32 12 16**  
**HOT-MIX ASPHALT CONCRETE PAVING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section addresses the requirements for installing hot-mix asphalt concrete. **Furnish and install hot mix asphalt concrete in accordance with City of Saratoga Springs Standard “02641 Bituminous Paving”** (which is available on-line at the City’s web site) and the following. Where the two specifications conflict the more stringent requirement shall apply.

**1.2 RELATED SECTIONS**

- A. Related work specified in other sections includes but is not limited to:

- |                        |   |
|------------------------|---|
| 1. Section 01 33 00    | Submittal Procedures                            |
| 2. Section 01 45 00    | Quality Control and Materials Testing           |
| 3. Section 01 50 00    | Temporary Facilities and Environmental Controls |
| 4. Section 32 11 23    | Road Base - Untreated Base Course               |
| 5. Section 32 11 24    | Pulverized Pavement Base Course (APWA)          |
| 6. Section 32 12 05    | Bituminous Concrete (APWA)                      |
| 7. Section 32 12 13.13 | Tack Coat (APWA)                                |
| 8. Section 32 12 16.13 | Plant-Mix Bituminous Paving (APWA)              |
| 9. Section 32 17 23    | Pavement Marking (APWA)                         |
| 10. Section 33 05 25   | Pavement Restoration (APWA)                     |

**1.3 REFERENCES**

- A. The American Public Works Association General Conditions and Standard Specifications for Construction, latest edition
- B. The latest edition of the following publication forms a part of this specification to the extent referenced. The publication is referred to in the text by basic designation only.
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
- |                |   |
|----------------|---|
| 1. ASTM D 2041 | Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures |
| 2. ASTM D 2950 | Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Method                      |
| 3. ASTM D 3665 | Standard Practice for Random Sampling of Construction Materials   |

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Laboratory mix design for proposed hot-mix asphalt concrete paving.
- C. Means and methods for removal, reprocessing, and placement of existing asphalt surfaces as base course material.

- D. Laboratory mix design for proposed tack coat application.
- E. Quality assurance tests for asphalt and aggregate material sources.
- F. Copies of batch delivery tickets shall be submitted during progress of the work, and shall show the following information:
  - 1. Name of production facility
  - 2. Serial number of ticket
  - 3. Date and truck number
  - 4. Name of CONTRACTOR
  - 5. Job name and location
  - 6. Weight of asphalt concrete
  - 7. Loading temperature
  - 8. Signature or initial of plant representative
  - 9. Type and grade of asphalt cement
  - 10. Type and grade of aggregate
  - 11. Applicable mix design method
  - 12. Separate weights of aggregate and asphalt
- G. Submit type and number of rollers required for compacting asphalt concrete

## **1.5 SITE CONDITIONS**

- A. Pave only when air and roadbed temperatures in the shade are greater than 40 deg. F and rising. The temperature restrictions may be waived only upon written authorization from ENGINEER.
- B. Do not pave during rain or unsuitable weather or when surface is wet.

## **1.6 ACCEPTANCE**

- A. Acceptance of hot-mix asphalt concrete paving is based upon minimum density, minimum thickness, smoothness, and surface appearance. Smoothness and surface appearance shall be as defined by City Standards, and Section 32 12 16.13 of the APWA Specifications, whichever is more stringent.

## **PART 2 PRODUCTS**

### **2.1 BITUMINOUS PAVEMENT**

- A. The bituminous material shall be per City Standards.
- B. Sampling and testing shall be the responsibility of CONTRACTOR, and shall be performed as required in Section 01 45 00 - Quality Control and Materials Testing.

### **2.2 TACK COAT**

- A. See City Standards.



## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Preparation shall conform to all requirements of City Standards and the following.
- B. CONTRACTOR shall map and mark all existing surface utilities within the line of work, and shall lower fixtures if pavement machine is not capable of passing over structure.
- C. All asphalt and concrete surfaces within the line of work are to be removed and disposed of properly by CONTRACTOR. CONTRACTOR may, upon written authorization of OWNER, use processed asphalt materials as base course material. Excess materials shall be removed and disposed by CONTRACTOR.
- D. Existing asphalt pavements and drive approach extensions to be removed shall be cut by a wheel cutter or other device capable of making a neat, reasonably straight and smooth cut without damaging adjacent pavement and/or concrete that is not to be removed. The cutting device operation shall be subject to the approval of ENGINEER.
- E. Any existing base, surfacing, or pavement shall be thoroughly cleaned immediately prior to receiving the plant-mixed surfacing. Where existing pavement is being widened or extended, it shall be cut to a straight vertical face prior to the paving operations and treated with asphalt paint binder.

### **3.2 BASE COURSE**

- A. Base course material shall be placed in accordance with Section 32 11 23 of these specifications.
- B. Base course surfaces shall be maintained in an acceptable condition for both moisture and density, as defined by Section 32 11 23 - Road Base – Untreated Base Course, until the overlying hot-mix asphalt cement materials have been placed, at no additional expense to OWNER.
- C. Processed asphalt materials may be used as base course provided that the resulting gradation for the 1" or 3/4" and -200 sieves comply with the requirements of Section 32 11 23 - Road Base. Processed asphalt materials may also be used if they meet the requirements of APWA Section 32 11 24 – Pulverized Pavement Base Course with the addition of stabilizers and if approved by the OWNER. Processed asphalt which has been contaminated with clay or silt materials will not be accepted.

### **3.3 PLACEMENT OF TACK COAT**

- A. Apply tack coat to all existing asphalt concrete surfaces preparatory to placing asphalt concrete pavement in accordance with City Standards.

### **3.4 PLACEMENT OF HOT-MIX ASPHALT CONCRETE**

- A. Place hot mix asphalt concrete in accordance with City Standards and the following.
- B. For all excavations within twenty-four (24) inches of any structure, concrete, or edge of existing pavement surface; CONTRACTOR shall remove and replace existing pavement surface to the concrete, structure, or edge of existing pavement surface.

- C. Where a longitudinal trench is partly in pavement, the pavement shall be replaced to the original pavement edge, on a straight line, parallel to the center line of the roadway.
- D. Where no part of a longitudinal trench is in the pavement, surfacing replacement will only be required where existing surfacing materials have been removed.
- E. Spreading shall be as nearly continuous as possible. The mixture shall be spread and struck off in such a manner that the finished surface shall result in a uniform smooth surface. The longitudinal joints in succeeding courses shall be offset at least 6 inches transversely to avoid a vertical joint through more than one course.
- F. All cold transverse joints shall be paper-patched or saw-cut to a clean vertical edge before paving resumes.
- G. Placement shall also allow for line, grade, elevations, and thickness specified herein and as shown on the drawings.
- H. When asphalt concrete is laid against vertical surfaces such as gutters, the face of the vertical surface shall be roughened for proper bonding, cleaned, and then painted with a light coating of asphalt cement or emulsified asphalt.
- I. At terminations of new surface course, the asphalt concrete shall be feathered into the existing surface over such a distance as may be required to produce a smooth riding transition. Base course and single course construction shall be joined by vertical butt joints finished and rolled to a smooth surface.
- J. Asphaltic concrete shall not be placed when frozen materials are present in the base or sub-base.
- K. Asphaltic concrete shall not be placed during adverse conditions, i.e., rain or when a roadway surface is wet.
- L. Asphalt concrete shall not be placed after October 15 and before April 15 of the following year unless roadway surface temperatures are 40° F and rising in the shade. Approval to place the asphalt concrete after October 15 and before April 15 of the following year requires written approval from the OWNER.
- M. Roadways not completed prior to October 15, and not meeting the requirements of this section, shall be repaired by placing a temporary 2-inch thick asphalt (or other ENGINEER approved surface) course over all exposed, earthen surfaces. These temporary surfaces shall be completely removed and repaired in accordance with these specifications at no additional expense to OWNER.
- N. Asphalt rolling shall be in accordance with City Standards. CONTRACTOR shall establish and document a rolling pattern for obtaining densities. The test strip shall be no shorter than 300 feet. Establishment of rolling patterns are for the purpose of establishing minimum rolling patterns, and shall not release CONTRACTOR of meeting all requirements of these specifications and drawings. After the mixture has been spread, the surface shall be rolled in longitudinal direction commencing at the outside edge or lower side and proceeding to the higher side. Each pass of the roller shall overlap the preceding pass at least one-half the width of the roller. Rolling shall continue until 95% of the laboratory density as determined in accordance with ASTM

Designation D1559 for the asphalt mixture being used has been obtained. Density tests shall be done following the procedures of ASTM D2950. Complete compaction before temperature drops to 180° F. Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller.

- O. The target density for asphalt placement shall be per City Standards.
- P. The minimum acceptable thickness of asphalt for completed roadways shall be 3 inches, as verified by core samples. Areas found to contain less than the minimum thickness shall be removed and replaced at no additional expense to OWNER.
- Q. Allowable tolerance shall be 1/4 inch vertical deviation from design elevation in 10 feet. Match existing adjacent surface slopes.
- R. The completed finish shall be as specified in City Standards. The surface of the pavement, after compaction, shall be uniform and true to the established grade. When tested with a ten-foot straight edge placed on the surface of the pavement, at any point, the surface shall not deviate more than one-eighth of an inch from the lower edge of the straight edge. All high and low spots shall be remedied immediately by removing the wearing course material over the affected areas and replacing it with fresh, hot wearing course and surface finish material and immediately compacting it to conform with the surrounding area.
- S. CONTRACTOR shall adjust the height of all street fixtures to match final grade. If required, concrete collars shall be placed around all surface street fixtures (i.e. manholes, valve boxes, monuments, etc.).
- T. CONTRACTOR shall complete all concrete collars within 2 weeks of completion of paving each roadway section.
- U. A 1% minimum cross-slope and 4% maximum cross-slope is required. Any slopes higher or lower than the required range must be approved by the City Engineer or designee.

### **3.5 REPAIR**

- A. Remove bumps and depressions exceeding 1/4 inch vertical deviation in 10 feet.
- B. Repair options include mill and inlay, or grinding. Feather edges on bituminous concrete repairs are not allowed. Apply a cationic or anionic tack emulsion to make miller surfaces water resistant.

### **3.6 SITE SAFETY AND TRAFFIC CONTROL**

- A. Site safety and traffic control shall be the responsibility of CONTRACTOR.
- B. CONTRACTOR shall verify full compliance with all applicable local, county, state and/or federal regulations, and shall comply with Section 01 55 26 Traffic Control.

- END OF SECTION -

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**SECTION 32 31 13**  
**CHAIN LINK FENCES AND GATES**

**PART 1 GENERAL**

**SUMMARY**

This section covers the furnishing of labor, materials, and appurtenances necessary for installation of the black PVC coated chain link fence system defined herein. The manufacturer shall provide a total fence system including all components, panels, posts, gates, and hardware required.

1.1

A.

**RELATED WORK**

Related Work specified in other Sections includes, but is not limited to:

1.2

Section 01 33 00 Submittal Procedures

A.

Section 03 30 00 Cast-in-Place Concrete

1.

2.

**REFERENCES**

1.3

A.

The latest edition of the following publications form a part of this Specifications to the extent referenced. The publications are referred to in the text to by basic designation only.

B.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

1.

ASTM A 780

Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

2.

ASTM F 552

Standard Terminology Relating to Chain Link Fencing

3.

ASTM F 567

Standard Practice for Installation of Chain Link Fence

4.

ASTM F 626

Standard Specification for Fence Fittings

5.

ASTM F 668

Standard Specification for Polyvinyl (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric

6.

ASTM F 900

Standard Specification for Industrial and Commercial Swing Gates

7.

ASTM F 934

Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials

8.

ASTM F1083

Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

9.

ASTM F1664

Standard Specification for Poly (Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence

1.4

A.

ASTM F1665

Standard Specification for Poly (Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used with Chain-Link Fence

**MEASUREMENT AND PAYMENT**

Full compensation for chain link fences and gates shall be considered at the contract unit bid prices for each lineal foot of chain link fences and gates installed and accepted.

## **SUBMITTALS**

Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

Shop drawings: Site plan showing layout of fence location with dimensions, location of gates and opening size, cleared area, elevation of fence, gates, footings and details of attachments.

1.5

- A. Certifications: Manufacturers material certifications in compliance with the current ASTM specifications.

B.

Domestic certifications: Material certifications, Made in U.S.A., Buy American Act or Buy America when required.

C.

- D. Material samples: When required, provide representative samples of chain link fabric, framework and fittings.

D.

E.

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

1.6

Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

A.

## **QUALITY ASSURANCE**

1.7

- A. Manufacturer: Company headquartered in the United States having U.S. manufacturing facility/facilities specializing in manufacturing chain link fence products with at least 5 years' experience.

B.

Fence contractor: Company with demonstrated successful experience installing similar projects and products in accordance with ASTM F567 and have at least 5 years' experience.

C.

1.8

Tolerances: Current published edition of ASTM specifications tolerances apply. ASTM specification tolerances supersede any conflicting tolerance.

A.

## **WARRANTY**

All structural fence components (i.e., rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

2.1

A.

## **PART 2 PRODUCTS**

C.

### **MANUFACTURERS**

Wheatland Tube Co.,

Master Halco, Inc.,

Southwestern Wire, Inc.,

Or approved equal

## GENERAL

Dimensions indicated herein for roll-formed pipe and H-sections are outside dimensions, excluding coatings.

D.

Fence fabric height shall be 6 feet unless otherwise indicated.

### 2.2

A.

Fencing materials shall be galvanized and PVC coated after fabrication.

B.

The color of the fencing fabric, poles, and fittings shall be **black**.

C.

Fencing shall be topped with 3 lines of barbed wire on single, 45 degree supporting arms, sloped outward. Fence height with barbed wire shall be over 6.6 feet.

D.

E.

## STEEL FABRIC

### 2.3

Fence fabric shall be 9 gauge steel wire, 2-inch mesh, with top selvages knuckled and bottom selvages twisted and barbed.

A.

Fabric shall be hot-dip galvanized and PVC coated according to ASTM F668, Class 2a or Class 2b. The weight of the zinc shall meet the requirements of STM F 668, Table 4.

B.

## FRAMING AND ACCESSORIES

### 2.4

A.

**Round steel pipe and rail:** Schedule 40 standard weight pipe, in accordance with ASTM F1083, 1.8 oz/ ft<sup>2</sup> hot dip galvanized zinc exterior and 1.8 oz/ft<sup>2</sup> hot dip galvanized zinc interior coating. Intermediate Strength Grade: Minimum yield strength 50,000 psi.

1.

2.

3.

Line post shall be 2-3/8" outside diameter, 1.8 oz/ft<sup>2</sup> zinc coating.

End, Corner, Pull post 2-7/8" outside diameter, 1.8 oz/ft<sup>2</sup> zinc coating.

Top, brace, bottom and intermediate rails, 1.660" outside diameter, 1.8 oz/ft<sup>2</sup> zinc coating.

B.

**Polymer Coated Pipe:** Polymer coated pipe shall have a PVC coating fused and adhered to the exterior zinc coating of the galvanized pipe in accordance with ASTM F1043. The minimum thickness of the PVC coating shall be 10-mils (0.254 mm). The color shall match fabric **black** per ASTM F934.

C.

D.

**Tension Wire:** Tension wire shall be located at the bottom of the fabric and shall consist of 7 gauge wire complying with ASTM F 1664. Wire gauge specified is the core wire gauge. The color shall match the coating of the chain link fabric and shall be Class 2a or Class 2b. Tension wire shall be interlaced with the fabric or attached to the fabric with wire ties at a spacing of no more than 18 inches apart.

E.

F.

**Barbed Wire Support Arms:** (Not Used).

**Barbed Wire:** (Not Used) .

**Tension and Brace Bands:** Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge (0.105 in.), minimum width of 3/4 inch and

minimum zinc coating of 1.20 oz/ft<sup>2</sup>. Secure bands with 5/16 inch galvanized steel carriage bolts.

**Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves:** In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft<sup>2</sup>.

G. **Truss Rod Assembly:** In compliance with ASTM F626, 3/8-inch diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz/ft<sup>2</sup>, assembly capable of withstanding a tension of 2,000 lbs.

H. **Tension Bars:** Tension bars shall conform to ASTM F626 and shall be galvanized steel one-piece length 2-inch less than the fabric height. Minimum zinc coating 1.2 oz. /ft<sup>2</sup>. Bars for 2 inch mesh shall have a minimum cross section of 3/16 inch by 3/4-inch.

I. **Polymer Coated Color Fittings:** In compliance with ASTM F626, PVC coating minimum thickness 0.006-inch fused and adhered to the zinc coated fittings. Match color to fence system.

J.

K. **Tie Wire and Hog Rings:** Galvanized minimum zinc coating 1.20 oz/ft<sup>2</sup>, 9-gauge (0.148") steel wire in compliance with ASTM F626. Tie wire and hog rings shall be polymer coated and match the color of the fence system.

## SWING GATES

### 2.5

A. **Swing Gates:** Galvanized steel pipe welded fabrication in compliance with ASTM F900. Gate frame members 1.900-inch outside diameter, ASTM F 1083 schedule 40 galvanized steel pipe. Frame members spaced no greater than 8 ft. apart vertically and horizontally. Welded joints protected by applying zinc-rich paint in accordance with ASTM Practice A 780. Positive locking gate latch, pressed steel galvanized after fabrication. Galvanized malleable iron or heavy gauge pressed steel post and frame hinges. Provide lockable drop bar and gate holdbacks with double gates. Match gate fabric to that of the fence system. Gateposts per ASTM F1083 schedule 40 galvanized steel pipe. The gatepost diameter from table 2.5.B. Gate frames and gate posts shall be PVC coated and match the color of the fence system.

B.

Gateposts: Schedule 40 pipe in compliance with ASTM F1083.

Gate fabric height up to and including 6 ft.		
Gate leaf width	Post Outside Diameter	Weight
up to 4 ft.	2.375 in.	3.65 lb/ft
over 4 ft. to 10 ft.	2.875 in.	5.79 lb/ft
over 10 ft. to 18 ft.	4.000 in.	9.11 lb/ft
Gate fabric height over 6 ft. to 12 ft.		
Gate leaf width		
up to 6 ft.	2.875 in.	5.79 lb/ft
over 6 ft. to 12 ft.	4.000 in.	9.11 lb/ft
over 12 ft. to 18 ft.	6.625 in.	18.97 lb/ft
over 18 ft. to 24 ft.	8.625 in.	28.58 lb/ft



## CONCRETE

Concrete for post footings shall have a 28-day compressive strength of 2,500 psi in accordance with Section 03 30 00 – Cast-in-Place Concrete.

### PART 3 EXECUTION

#### 2.6

#### FRAMEWORK INSTALLATION

A.

Posts: Posts shall be set plumb in concrete footings in accordance with ASTM F567. Minimum footing depth, 24 inch plus an additional 3 inch depth for each 1 ft. increase in the fence height over 4 ft. or as indicated on the contract drawings whichever is greater. The minimum footing diameter shall be four times the largest cross section of the post up to a 4.00" dimension and three times the largest cross section of post greater than a 4.00" dimension or as indicated on the contract drawings, whichever is greater. Top of concrete footing to be at grade and crowned to shed water away from the post. Line posts installed at intervals not exceeding 10 ft. on center.

#### 3.1

A.

Top rail: When specified, install 21 ft. lengths of rail continuous thru the line post or barb arm loop top. Splice rail using top rail sleeves minimum 6 inches long. Rail shall be secured to the terminal post by a brace band and rail end. Bottom rail or intermediate rail shall be field cut and secured to the line posts using boulevard clamps or brace band with rail end. Fences 12 feet high or higher require mid rail.

B.

C.

Terminal posts: End, corner, pull and gate posts shall be braced and trussed for fence 6 ft. and higher and for fences 5 ft. in height not having a top rail. The horizontal brace rail and diagonal truss rod shall be installed in accordance with ASTM F567.

D.

Tension wire: Shall be installed 4 inches up from the bottom of the fabric. Fences without top rail shall have a tension wire installed 4 inches down from the top of the fabric. Tension wire to be stretched taut, independently and prior to the fabric, between the terminal posts and secured to the terminal post using a brace band. Secure the tension wire to each line post with a tie wire. Install the top tension wire through the barb arm loop for fences having barbed wire and no top rail.

#### 3.2

A.

#### CHAIN LINK FABRIC INSTALLATION

Chain Link Fabric: Install fabric to outside of the framework. Attach fabric to the terminal post by threading the tension bar through the fabric; secure the tension bar to the terminal post with tension bands and 5/16 inch carriage bolts spaced no greater than 12 inches on center. Chain link fabric shall be stretched taut free of sag. Fabric to be secured to the line post with tie wires spaced no greater than 12 inches on center and to horizontal rail spaced no greater than 18 inches on center. Secure fabric to the tension wire with hog rings spaced no greater than 18 inches on center.

1.

#### 3.3

Tie wire shall be wrapped 360 degrees around the post or rail and the two ends twisted together three full turns. Excess wire shall be cut off and bent over to prevent injury. The installed fabric shall have a ground clearance on no more than 2 inches.

#### BARBED WIRE INSTALLATION (NOT USED)

## **GATE INSTALLATION**

Swing Gates: Installation of swing gates and gateposts in compliance with ASTM F 567. Direction of swing shall be inward. Gates shall be plumb in the closed position having a bottom clearance of 3 inch, grade permitting. Hinge and latch offset opening space shall be no greater than 3 inches in the closed position. Double gate drop bar receivers shall be set in a concrete footing minimum 6 inch diameter 24 inch deep. Gate leaf holdbacks shall be installed for all double gates.

3.4

A.

## **CLEAN UP**

Clean Up: The area of the fence line shall be left neat and free of any debris caused by the installation of the fence.

3.5

A.

- END OF SECTION -

**SECTION 32 31 19**  
**ORNAMENTAL METAL FENCES AND GATES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section covers the furnishing of labor, materials, and appurtenances necessary for installation of the ornamental metal fence system defined herein. The manufacturer shall provide a total fence system including all components, panels, posts, motorized, remote controlled gate, and hardware required.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
1. Section 01 33 00 Submittal Procedures
  2. Section 03 30 00 Cast-in-Place Concrete
  3. Section 31 23 23 Excavation and Backfill for Structures

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specifications to the extent referenced. The publications are referred to in the text to by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
  2. ASTM B 117 Standard Practice for Operating Salt-Spray (Fog) Apparatus.
  3. ASTM B 221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  4. ASTM D 523 Standard Test Method for Specular Gloss.
  5. ASTM D 714 Test Method for Evaluating Degree of Blistering in Paint.
  6. ASTM D 822 Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
  7. ASTM D 1654 Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
  8. ASTM D 2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
  9. ASTM D 2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
  10. ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test.
  11. ASTM F 2408 Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.

**1.4 MEASUREMENT AND PAYMENT**

- A. Full compensation for ornamental metal fences and gates shall be considered at the contract unit bid prices for each lineal foot of ornamental metal fences and gates installed and accepted.

## **1.5 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Contractor shall submit Manufacturer's product data and installation instructions for approval.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

## **1.7 QUALITY ASSURANCE**

- A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

## **1.8 WARRANTY**

- A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.
- B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufacturer's warranty shall be guaranteed for five (5) years from date of original purchase.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Ameristar Montage II, Classic, Industrial (complete fencing system), or approved equal.
  - 1. Style: Classic 3-rail style with flush rail on the bottom.
  - 2. Hardware: Brackets shall be the Universal Boulevard Bracket wrap around style. Bolts shall be tamper proof bolts.

### **2.2 MATERIALS**

- A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653, with a minimum yield strength of 45,000 psi and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz/sq. ft., Coating Designation G-90.
- B. Material for pickets shall be 1" square x 14 Ga. tubing. The rails shall be steel channel, 1.75" x 1.75" x 0.105". Picket holes in the rail shall be spaced 4.715" o.c. Fence posts and gate posts shall meet the minimum size requirements of Table 1.
  - 1. Provide 6-foot-tall fencing, and:
    - a. posts at 8 feet on center spacing
    - b. each picket shall have a simple pointed picket top.

<b>Table 1 – Minimum Sizes for Posts</b>			
<u>Fence Posts</u>	<u>Panel Height</u>		
2-1/2" x 12 Ga.	Up to & Including 6' Height		
3" x 12 Ga.	Over 6' Up to & Including 8' Height		
<u>Gate Leaf Width</u>	<u>Gate Height</u>		
	<u>Up to &amp; Including 4'</u>	<u>Over 4' Up to &amp; Including 6'</u>	<u>Over 6' Up to &amp; Including 8'</u>
Up to 4'	2-1/2" x 12 Ga.	3" x 12 Ga.	3" x 12 Ga.
4'1" to 6'	3" x 12 Ga.	4" x 11 Ga.	4" x 11 Ga.
6'1" to 8'	3" x 12 Ga.	4" x 11 Ga.	6" x 3/16"
8'1" to 10'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
10'1" to 12'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
12'1" to 14'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
14'1" to 16'	6" x 3/16"	6" x 3/16"	6" x 3/16"

## 2.3 FABRICATION

- A. Pickets, rails, and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.
- B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by welding, thus completing the rigid panel assembly.
- C. The manufactured panels and posts shall be subjected to an inline electrodeposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. Minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm).
- D. The color shall be Black.
- E. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).

<b>Table 2 – Coating Performance Requirements</b>		
<u>Quality Characteristics</u>	<u>ASTM Test Method</u>	<u>Performance Requirements</u>
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

- F. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.
- G. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection.

## **2.4 GATES**

- A. Manufacturer shall design and recommend gates and gate components for the gate types and sizes called on the plans, and submit complete details of each gate and gate components including the following.
  - 1. Provide each gate with locking device to accept City padlock.
  - 2. Provide all gates complete and installed per manufacturer's instructions. Provide 2 days of manufacturer time onsite to test, retest and adjust gate so it operates smoothly and reliably. Provide manufacturer certification gate is installed and operating per manufacturers recommendations.
- B. Swing gates shall be fabricated using 1.75-inch x 14ga Forerunner double channel rail, 2-inch sq. x 11ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6 feet in width will have a 1.75-inch sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gates leaves over 6 feet.

## **2.5 CANTILEVER SLIDE GATES**

- A. Require Function and Materials
  - 1. Provide a "TransPort Traverse II" roller gate to span 26-foot minimum clear opening with posts set in concrete.
  - 2. Gate shall have electric gate operator including gate controls, motor, buried power conduit and cable to locally mounted gate controls push button pad (post mounted 15' north of gate at east side of asphalt driveway so driver can remain in truck and open gate) and three remote control battery actuated open-close devices that can be mounted in trucks to allow for remote push button gate opening and closing.
  - 3. The materials used for cantilever gate framing (uprights & diagonal bracing) shall be manufactured from ASTM B 221 aluminum (designation 6063-T-6) with yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish. The TransPort™ enclosed tracks shall be manufactured from ASTM B 221 aluminum (designation 6063-T-6) with a yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish.
  - 4. Material for pickets shall be 1-inch square x 1/8-inch wall aluminum pickets on gate systems greater than 24-foot openings, gate systems less than 24-foot openings shall have 1-inch square x 16 ga. steel pickets. Picket on center spacing shall not exceed 5 inches. Pickets shall be securely fastened to face of top and bottom enclosed track extrusions.
  - 5. Material for gate uprights and diagonal bracing shall be 2-inch square x 1/4-inch wall aluminum. The cross-sectional shape of the enclosed-track shall confirm to the manufacturers Fast-Trak™ design with as a single extrusion consisting of a 2-inch x

- 5-inch channeled support with integrated 2-inch x 2-inch enclosed-track raceway. Gates less than 24-foot openings shall be constructed as a single-track system, gates greater than 24-foot openings shall be constructed as a dual track system.
6. Steel material for fence posts and pickets shall be galvanized prior to forming in accordance with the requirements of ASTM A 653, with minimum yield strength of 45,000 psi. The steel shall be hot-dip galvanized to meet the requirements of ASTM A 653 with a minimum zinc coating weight of 0.90 oz/ft<sup>2</sup>, Coating Designation G-90. Material for gate support posts shall be 4-inch square x 11 Ga. tubing.
  7. Suspension Rollers for enclosed tracks shall be used at each support post to track connection. Each truck assembly shall be capable of being adjusted vertically via threaded rod for fine-tune adjustment. Truck assembly shall be constructed in a way so that the primary housing for the truck rollers shall pivot via ball-bearing connection to threaded rod.

#### B. Fabrication

1. Gate frame uprights and diagonal bracing shall be prefabricated and pre-punched to accept frame fasteners. Enclosed track shall be pre-punched to accept gate uprights. Pickets shall be pre-cut to specified length and pre-drilled to accept picket to track fasteners. Posts shall be pre-cut to specified lengths.
2. Top and bottom enclosed track extrusions shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Diagonal bracing shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Pickets shall be mechanically fastened to top and bottom enclosed track, as required by assembly instructions.
3. The manufactured gate components shall be subjected to a thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils. The color shall be Black to match adjacent fencing. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 32 31 19 - 3.

<b>Table 32 31 19 - 3 – Coating Performance Requirements</b>		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D 3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B 117, D 714 & D 1654	Corrosion Resistance 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8-inch coating loss from scribe or medium #8 blisters).
Impact Resistance	D 2794	Impact Resistance over 60-inch lb. (Forward impact using 0.625-inch ball).
Weathering Resistance	D 822 D 2244, D 523 (60 deg Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

## **2.6 ELECTRIC GATE OPERATOR**

- A. Manufacturer or approved equal:
  - 1. Liftmaster SL595UL Elite Series
  - 2. Linear OSCO GSLG-A Series
  - 3. Doorking DKS 9200 Series
- B. Size and certify the motor based on the width and weight of the gate to be operated. Gate operator shall be UL listed and meet all current safety requirements. Electric gate operator to consist of and/or meet the following minimum requirements:
  - 1. Enclosed reversing, minimum 1 horsepower motor, 460 volts, 3-phase.
  - 2. Heavy gauge steel frame for pad mounting.
  - 3. All-weather hinged cover with provision for padlocking.
  - 4. Adjustable safety friction clutch.
  - 5. Adjustable limit switches, rotary type.
  - 6. Magnetic solenoid locking brake.
  - 7. Emergency disconnect for manual operation in case of power failure.
  - 8. Magnetic reversing starter (size "1" contactor type) with overload and undervoltage protection.
  - 9. Factory pre-wired electrical system.
  - 10. Permanent lubricated heavy-duty bearings and heavy-duty roller chain.
- C. Electric gate operator to be located as indicated. Operator to have parallel three-button illuminated control stations ("OPEN," "STOP," and "CLOSE").
- D. Electric gate operator system shall include a preformed reversing loop on each side of the gate and a preformed automatic open exit loop on the secure side of the gate as shown on the Contract Drawings. Preformed loops shall be 8-feet by 4-feet. Loops shall be manufactured with three turns of XLPE insulated 18 AWG stranded wire in different colors for easy loop identification. Wires shall be encased in tubing to protect the wire and to make a watertight enclosure. Provide loop detectors as required by the manufacturer.
- E. Electric gate operator system shall include controller and secondary keypad/card reader combination operators installed on the high and low mounting post as shown on the Contract Drawings. Controller shall be programmable to hold gate open during working hours and to remain closed on weekends and holidays.
- F. Provide electrical conduit, switches, wiring, and connections specified under the applicable electrical sections of Division 26 and as shown in Electrical Plans.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. All new installation shall be laid out by the contractor in accordance with the construction plans.



### 3.2 FENCE INSTALLATION

- A. Fence post shall be spaced according to Table 32 31 19-4, plus or minus 1/2 inch. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36 inches. Section 03 30 00 Cast-in-Place Concrete shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application. Foundation soils shall be excavated as required for footing base/leveling pad dimensions shown on the Contract Drawings, or as directed by ENGINEER.

Table 32 31 19-4 – Post Spacing By Bracket Type										
Span	For 8' Nominal (91.5" Rail)				For 8' Nominal (92.625" Rail)					
Post Size	2.5"	3"	2.5"	3"	2.5"	3"	2.5"	3"	2.5"	3"
Bracket Type	Industrial Flat Mount*		Industrial Line 2.5" or 3"		Industrial Universal 2.5" or 3"		Industrial Flat Mount		Industrial Swivel*	
Post Settings ± 1/2" O.C.	94.5"	95"	94.5"	95"	96"	96.5"	96"	96.5"	*96"	*96.5"
*Note: When using swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel. When using the flat mount bracket for 91.5" rail, rail may need to be drilled to accommodate rail to bracket attachment.										

### 3.3 FENCE INSTALLATION MAINTENANCE

- A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces;
1. Remove all metal shavings from cut area.
  2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
  3. Apply 2 coats of custom finish paint matching fence color.
- B. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Spray cans or paint pens provided by the manufacturer shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-manufacturer parts or components may negate the manufactures' warranty.

### 3.4 GATE INSTALLATION

- A. Provide 2 days of manufacturer assistance onsite to test automated motorized cantilevered 26-foot (min) gate on rollers including its post-mounted keypad and its three (3) battery operated remote gate actuators which can be carried in trucks.
- B. All gate components, including gate posts design and spacing, shall be according to manufacturers' gate drawings. Gate post design and spacing shall be dependent on standard out-to-out gate leaf dimensions and gate hardware recommended by manufacturer.

- C. For any swing gates, type and quantity of gate hinges shall be based on the application, weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations.
- 1. For each double swing gate, provide heaviest available Manufacturer-recommended drop rod and drop rod receiving cylinder (to be anchored in concrete at center of 2 gate panels).

### **3.5 ELECTRIC GATE OPERATOR INSTALLATION**

- A. The electric gate operator, preformed detection loops, controller/keypads, and mounting post shall be installed as indicated on the Contract Drawings and in accordance with the manufacturer's written instructions.
- B. Gate operator installer shall assist OWNER in programming the gate. Gate shall be programmed to use key cards or entry code on the keypad. Gate shall be able to be programmed to remain open during business hours and to remain closed on weekends and holidays.

### **3.6 CLEANING**

- A. CONTRACTOR shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

- END OF SECTION -

**SECTION 33 05 02**  
**REINFORCED CONCRETE PIPE**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall construct the reinforced concrete pipelines (RCP) for the tank overflow and site drainage complete, and in place, including connections to new and existing structures, all in accordance with the Contract Documents.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:

- |    |                  |   |
|----|------------------|---|
| 1. | Section 01 33 00 | Submittal Procedures                        |
| 2. | Section 31 23 15 | Excavation and Backfill of Buried Pipelines |
| 3. | Section 33 08 30 | Gravity Pipeline Testing                    |

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

- |    |             |  |
|----|-------------|--|
| 1. | ASTM C 76   | Standard Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe                 |
| 2. | ASTM C 443  | Standard Specifications for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets              |
| 3. | ASTM C 596  | Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement                      |
| 4. | ASTM D 3212 | Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals |
| 5. | ASTM F 477  | Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe                      |

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit manufacturer's data sheets on reinforced concrete pipe showing pipe dimensions, rubber gaskets, pipe connectors, and other appurtenances.
- C. Submit manufacturer's information on grout.
- D. CONTRACTOR shall furnish certificates to ENGINEER guaranteeing that the pipe is in compliance with the requirements of these Specifications.

**1.5 QUALITY ASSURANCE**

- A. Pipe shall be subject to inspection at the place of manufacture. Notify ENGINEER not less than 14 days prior to the start of any phase of the pipe manufacture. During

manufacture ENGINEER shall be given access to all areas of the process and shall be permitted to make inspections necessary to confirm compliance with the Specifications.

- B. Materials used in the manufacture of the pipe shall be tested in accordance with this Section and the referenced standards. CONTRACTOR shall perform said material tests. ENGINEER shall have the right to witness testing provided that CONTRACTOR's schedule is not delayed for convenience of ENGINEER.

## PART 2 PRODUCTS

### 2.1 PIPE MATERIALS

- A. Reinforced Concrete Pipe: For 12-inch through 30-inch diameter reinforced concrete pipes shall conform to the requirements of ASTM C 76 for Class III, Wall B, and Type II modified or V cement and for 36-inch through 72-inch diameter reinforced concrete pipes shall conform to the requirements of ASTM C 76 for Class III, Wall C, and Type II modified or V cement; provided, that pipe shall have tongue and groove joint designed to be self-centering. Pipe shall be designed for an internal pressure of 7 feet of water, and an external design loading meeting AASHTO HS-20-44, soil weight of 120 pcf, and minimum cover depth of 1 foot. Pipe manufacturer shall be **Geneva Pipe and Precast, Inc., Oldcastle Infrastructure, Inc.**, or approved equal.
- B. Bell and spigot joints, including rubber gaskets, shall conform to the requirements of the latest revision of ASTM C443. Pipe joints shall be so designated as to provide for self-centering and when assembled, to compress the gasket to form a watertight seal. The gasket shall be confined in a groove on the spigot so that pipe movement or hydrostatic pressure cannot displace the gasket. Each pipe section shall be identified by a stamp indicating:
  - 1. Name of Manufacturer
  - 2. Date of Manufacture
  - 3. Pipe Classification
  - 4. Top of pipe
- C. Quick Setting Grout: Grout shall be a high strength, non-staining grout approved by ENGINEER prior to use. It shall reach an initial set within 90 minutes at 70° F (21° C) and shall reach minimum compressive strength of 2,500 psi (17 mPa) within 24 hours. Shrinkage shall be less than 0.1 percent when tested, using the test procedures of ASTM C 596. The grout shall be mixed, handled, and placed in accordance with the manufacturer's written instructions.
- D. Service Connectors: Service connectors 3-inch through 6-inch diameter shall consist of a PVC hub, rubber sleeve, and stainless-steel band. Connection shall be a compression fit into a cored wall of a mainline pipe. Rubber sleeve and gasket shall meet the requirements of ASTM F 477. Joints shall meet the requirements of ASTM D 3212. Service connector shall be **Inserta Tee by Inserta Fittings Co.**, or approved equal.

## **PART 3 EXECUTION**

### **3.1 EXCAVATION AND BACKFILL**

- A. Excavation and backfill of trenches and for appurtenances and backfilling for reinforced concrete pipe shall be in accordance with Section 31 23 15 Excavation and Backfill for Buried Pipelines.

### **3.2 INSTALLATION**

- A. All pipes shall be installed accurately to the defined line and grade. Variance from established line and grade shall not be greater than one thirty-second ( $1/32$ ) of an inch per inch of pipe diameter and not to exceed one-half ( $1/2$ ) inch, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoin ends of pipe due to non-concentricity of joining surface and pipe interior surfaces does not exceed one sixty-fourth ( $1/64$ ) inch per inch of pipe diameter, or one-half inch maximum.
- B. All concrete pipe installation shall proceed upgrade on a stable foundation with joints closely and accurately fitted. Rubber gaskets shall be fitted properly in place and care shall be taken in joining the pipe units to avoid twisting of gaskets. Joints shall be clean and dry before a joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint surface to facilitate easy positive joint closure.
- C. Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.
- D. Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.
- E. In addition to the above mentioned requirements, all pipe installation shall comply to the specific requirements of the pipe manufacturer.
- F. During the pipe installation, the trench shall be sufficiently dewatered that the joints will be free of water when jointed.

### **3.3 SERVICE CONNECTION**

- A. Installation shall be in accordance with manufacturer's recommended installation guidelines. Backfill around the service connection shall be of the same material type and compaction level as specified for the mainline pipe installation.

### **3.4 PRELIMINARY CLEANING**

- A. CONTRACTOR shall clean the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material are not left in any of the pipeline.
- B. Do not flush sand, gravel, concrete, debris, or other materials into existing piping systems.

### **3.5 TESTING OF PIPELINE**

- A. Testing for the reinforced concrete pipe shall be in accordance with Section 33 08 30 – Gravity Pipeline Testing.

- END OF SECTION –

**SECTION 33 05 03**  
**COPPER PIPE**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. CONTRACTOR shall furnish and install all copper pipes, fittings, couplings, supports, joint materials and appurtenances as shown and specified, and as required for a complete and workable piping system.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 22 10 10 Plumbing Piping and Specialties
  - 3. Section 33 12 00 Mechanical Appurtenances
  - 4. Section 33 13 00 Pipeline Testing and Disinfection

**1.3 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for this section. Full compensation for Copper Pipe shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which Copper Pipe relates.

**1.4 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM B88 Standard Specification for Seamless Copper Water Tube
- C. AMERICAN WATER WORKS ASSOCIATION (AWWA)
  - 1. AWWA C 800 Standard for Underground Service Line Valves and Fittings
- D. INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)
- E. INTERNATIONAL PLUMBING CODE (IPC)
- F. INTERNATIONAL MECHANICAL CODE (IMC)

**1.5 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

- B. Submit catalog information on all fittings and valves shown on the Contract Drawings, referencing each item by number as shown on the Contract Drawings. Information shall indicate manufacturer specification compliance and dimensional data.

## **1.6 QUALITY ASSURANCE**

- A. Reject any pipe which does not conform to Contract Documents or is cracked, chipped, crushed, dented, kinked, or otherwise unacceptable.

## **PART 2 PRODUCTS**

### **2.1 PIPE**

- A. The type and class of the pipe and fittings shall be as indicated on the Contract Drawings and shall be Type K copper for buried services lines and Type L copper for interior piping.
- B. Type K and Type L copper pipe shall have smooth surfaces free from bumps. Type K shall also be flexible enough to be coiled. All piping shall have the capacity to function at design working pressures.
- C. Copper pipe to be buried or encased in concrete shall be polyethylene coated or installed in a polyethylene sleeve. Polyethylene coated pipe shall have a coating thickness of 0.025 inches and shall be **Mueller Industries Streamline Plastic Coated Pipe**, or approved equal. Polyethylene sleeve shall be a minimum 6 mil thick and shall be **Northtown Polywrap C**, or approved equal. Color shall be blue for cold water, red for hot water, or purple for reclaimed water. Seal seam joints and around fittings with **Polyken #930**, or approved equal, adhesive tape.

### **2.2 CONNECTIONS AND FITTINGS**

- A. Connections shall be flared or compression type for service lines. All other connections for above ground and in interior to structures shall be hot 95-5 lead free soldered joints.
- B. Connections for dissimilar piping shall include dielectric insulation unions.
- C. Fittings shall conform to AWWA C-800 standards and shall be capable of operating at 150 psi.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Pipe shall be installed per manufacturers' instructions and per the requirements of the INTERNATIONAL PLUMBING CODE (IPC) and INTERNATIONAL MECHANICAL CODE (IMC). In case of a conflict between the two installation requirements the more stringent requirement shall apply.
- B. The pipe shall be plugged at the end of each workday or period of suspension.



### **3.2 PRELIMINARY CLEANING AND FLUSHING**

- A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that any foreign materials do not remain in any of the piping.

### **3.3 TESTING OF PIPING**

- A. Source of Water: CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.
- B. Testing Procedure:
  - 1. Pipe shall be tested in accordance with the INTERNATIONAL PLUMBING CODE, Section 312 - Tests and Inspections.
  - 2. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall repeat the pipeline testing until the pipeline passes the leakage test, all at no additional cost to OWNER.
  - 3. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

### **3.4 DISINFECTION**

- A. For all potable water systems and where otherwise required all pipelines shall be disinfected in accordance with Section 33 13 00 – Pipeline Testing and Disinfection and approved before being allowed to be connected into a culinary system. Sewer pipelines do not require disinfection.
- B. Source of Water: CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection of the water line system.

- END OF SECTION –

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**SECTION 33 05 05**  
**DUCTILE IRON PIPE**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall furnish and install all pipe, fittings, closure pieces, supports, bolts, nuts, gaskets, jointing material, polyethylene wrap, marker tape, tracer wire, and appurtenances as shown and specified, and as required for a complete and workable piping system.

**1.2 RELATED WORK**

- A. Related work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 50 30 Protection of Existing Utilities
3. Section 09 90 00 Painting and Finishes
4. Section 31 23 15 Excavation and Backfill for Pipelines
5. Section 33 12 00 Mechanical Appurtenances
6. Section 33 13 00 Pipeline Testing and Disinfection

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ASTM D 2041 Cast-Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250

C. AMERICAN STANDARDS FOR TESTING AND MATERIAL (ASTM)

1. ASTM A 193 Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
2. ASTM A 194 Standard Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
3. ASTM A 283 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
4. ASTM A 536 Standard Specification for Ductile Iron Castings

D. American Society of Mechanical Engineers (ASME)

1. ASME B1.1 Unified Inch Screw Threads, (UN And UNR Thread Form)
2. ASME B18.2.1 Square, Hex, Heavy Hex, And Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, And Lag Screws (Inch Series)
3. ASME B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, And Coupling Nuts (Inch Series)

## **E. AMERICAN WATER WORKS ASSOCIATION (AWWA)**

- |                |  |
|----------------|--|
| 1. AWWA C 104  | Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings                   |
| 2. AWWA C 105  | Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems                     |
| 3. AWWA C 110  | Standards for Ductile-Iron and Gray-Iron Fittings, 3-inch Through 48-inch, for Water   |
| 4. AWWA C 111  | Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings          |
| 5. AWWA C 115  | Standard for Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges |
| 6. AWWA C 150  | Standard for the Thickness Design of Ductile-Iron Pipe                                 |
| 7. AWWA C 151  | Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water                          |
| 8. AWWA C 153  | Standard for Ductile-Iron Compact Fittings, 3-inch Through 64-inch for Water           |
| 9. AWWA C 219  | Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe                          |
| 10. AWWA C 600 | Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances          |
| 11. AWWA C 606 | Standard for Grooved and Shouldered Joints   |
| 12. AWWA C 651 | Standard for Disinfecting Water Mains  |
| 13. AWWA M 11  | Steel Pipe – A Guide for Design and Installation                                       |

### **1.4 SUBMITTALS**

- A. Submit catalog information on all pipe, fittings, valves, couplings, gaskets, tapes, bolts and nuts, wraps, safety tapes, and tracer wires as shown on the Drawings. Information shall indicate manufacture specification compliance and dimensional data.
- B. Submit shop drawings on all fabricated piping and pipe supports.
- C. Submit bolting patterns, procedures, and bolting equipment data, and calculations for target torque calculations.
- D. Certified affidavit of compliance for pipe and fittings or other materials furnished under this Section and as specified in the referenced standards.

### **1.5 QUALITY ASSURANCE**

- A. Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

## **PART 2 PRODUCTS**

### **2.1 DUCTILE IRON PIPE**

- A. Ductile iron pipe shall conform to the requirements of the AWWA C151 and AWWA C150 and pipe must be certified for potable water use by the National Sanitation Foundation (NSF/ANSI 61) and must bear the logo "NSF-pw" or "NSF-61" indicating such certification. Pipe shall be rated to 350 psi. The pipe shall be provided with rubber gaskets, specials, and fittings as required. Nominal pipe laying lengths shall be 18-feet.

- B. Buried Ductile Iron Pipe shall be encased with 8 mil (minimum), Group 2, Class C black polyethylene, conforming to the requirements of AWWA C105. All seams in the polyethylene encasement shall be taped with a minimum 12 mil adhesive tape, **Polyken #900, 3M Scotchrap 51**, or approved equal, to completely seal the seam.

## 2.2 FITTINGS

- A. MJ and Push-on fittings shall conform to the (AWWA C110 or C153), be NSF certified to ANSI/NSF 61 and shall be for a minimum rated working pressure of 350 psi.
- B. Flanges shall conform to AWWA C110 AWWA C111, and ANSI B16.1, Class 250 and shall have either raised or plain faces and shall have a minimum working pressure rating of 350 psi. For pipe sizes 24-inch and smaller, flanged joints may be rated for a maximum of 350 psi with the use of specially designed gaskets.
- C. All buried fittings shall be completely coated with food grade grease, **Chevron FM Grease**, or approved equal, and shall be completely encased with 8 mil (minimum), Group 2, Class C polyethylene, conforming to AWWA C105 and color to match the pipe wrap. All seams in the polyethylene encasement shall be taped with a minimum 12 mil adhesive tape, **Polyken #900, 3M Scotchrap 51**, or approved equal, to completely seal the seam.

## 2.3 DUCTILE IRON PIPE JOINTS

- A. Ductile iron pipe and fittings shall be furnished with mechanical joints, push-on joints, flanged joints, or restrained joints as required.
  - 1. Mechanical and push-on joints shall conform to the requirements of AWWA C111.
  - 2. Flanged joints shall conform to the requirements of AWWA C115.
  - 3. Restrained joints shall conform to the requirements of AWWA C151. Restrained joints shall be **Flex-Ring, Field Flex-Ring, or Lok-Ring by American Ductile Iron Pipe, Field Lok, TR-Flex by U.S. Pipe**, or approved equal.
  - 4. Joint restraining devices that impart point loads and/or wedging action on the pipe wall as a means of joint restraint shall not be allowed unless there are no other options available. CONTRACTOR may propose such devices by providing a formal substitution request indicating the locations the devices are to be used and that the devices is rated at least for the class of pipe being supplied. The devices shall be **MegaLug Model 1100 by EBAA Iron**, or approved equal.

## 2.4 MECHANICAL-TYPE COUPLINGS (GROOVED)

- A. Mechanical-type couplings shall be provided where indicated on the Drawings and shall conform to the requirements of AWWA C606. Mechanical type couplings shall be designed for a water working pressure not less than the design pressure of the pipe on which they are to be installed. Mechanical-type couplings shall be **Victaulic Style 31 (flexible or rigid)**, or approved equal.
- B. Gaskets shall be the flush seal type.
- C. Mechanical-type couplings for equipment connections shall be provided with rigid grooved couplings or flexible type coupling with harness, unless thrust restraint is provided by other means.

- D. Grooved fittings, couplings and valves shall be furnished from the same manufacturer as the coupling. Grooving tools shall be from the same manufacturer as the grooved components.

## **2.5 SOLID SLEEVE-TYPE COUPLINGS**

- A. Solid sleeve-type couplings shall be provided where shown on the Contract Drawings. Coupling shall be of ductile iron and shall be of the size to fit the pipe and fittings shown. Coupling shall be pressure rated 350 psi and comply with AWWA C110. Restraints shall be provided where indicated on the Contract Drawings.

## **2.6 RESTRAINED BOLTED SLEEVE-TYPE COUPLINGS**

- A. Restrained bolted sleeve-type couplings shall be provided where shown on the Contract Drawings. Couplings shall be of ductile iron or ASTM A283 Grade C steel, without pipe stop, and shall be of sizes to fit the pipe and fittings shown. Coating shall be fusion bond epoxy. Couplings shall be the rated for 350psi and comply with AWWA C219. Sleeve length shall be 7 inches for pipe diameters 4-inch through 12-inch and 10 inches for pipe diameters 14-inch and larger. Restraint gland shall be ductile iron meeting the requirements of ASTM A 536. Couplings shall be **Series 470 by Smith-Blair, Style 400RG by Romac, Series 3800 by EBAA Iron, Inc.**, or approved equal.

## **2.7 FLANGE COUPLING ADAPTER (DISMANTLING JOINT)**

- A. Provide flanged coupling adapters (dismantling joint) were shown on the Contract Drawings. CONTRACTOR will not be allowed to substitute any other type of flanged coupling adapter unless approved by ENGINEER. The coupling shall be rated as indicated on the Contract Drawings.
- B. Flanged coupling adapter bodies shall be fabricated from steel, ASTM A512 or A 513 or Ductile Iron ASTM A536, without pipe stop. The body shall not be less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected. If the strength of the body material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe. The follower ring shall be fabricated from steel, ASTM A576 or A36.
- C. For flanged coupling adapters installed in piping systems rated for positive pressure, the coupling shall be restrained with harness bolts or tie rods. Other means of restraining the coupling such as set screws will not be accepted. Harnesses shall be designed in accordance with AWWA Manual 11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.
- D. Gaskets shall be composed of a rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.
- E. Flanged coupling adapters (dismantling joints) shall be **Model 975 by Smith-Blair, Model 309 by JCM, Model DJ400 by Romac**, or approved equal.

## **2.8 GASKETS**

- A. Except as otherwise provided, gaskets for flanged joints shall be 1/8-inch thick rubber fabric. Class 2500 or less flange gaskets shall be **Flange-Tyte by U.S. Pipe**, higher

pressure joint gaskets shall be **Garlock BLUE-GARD Style 3000**, or approved equal. Wherever blind flanges are shown, the gaskets shall consist of 1/8-inch thick cloth-inserted rubber sheet which shall cover the entire inside surface of the blind flange and shall be cemented to the surface of the blind flange.

- B. All buried fittings using steel bolts shall be coated with no-oxide wax and wrapped with polyethylene or as otherwise approved by ENGINEER.

## **2.9 BOLTS AND NUTS**

- A. Bolts and nuts shall be rated for the system working pressure with a minimum safety factor of three. Bolts and nuts buried and inside vaults shall be zinc coated steel. Bolts and nuts above grade, exposed or inside structures, shall be Type 304 stainless steel. Bolts and nuts in exposed to wastewater or in corrosive environments shall be Type 304 stainless steel.
- B. All flange bolt lengths shall be selected by CONTRACTOR such that three full threads, as a minimum, protrude from the hex nut and washer after assembly.
- C. Flange bolts shall have ASME B1.1, Class 2A threads, and be manufactured of ASTM A 193, Grade B7 steel. Bolts shall conform to ASME B18.2.1.
- D. Flange nuts shall have Class 2A fit, and be manufactured of ASTM A 194, Grade 2H steel, having square or hex heavy dimensions in accordance with ASME B18.2.2.
- E. Connection T-bolts for mechanical joint (MJ) fittings shall be Cor-Ten high strength, low alloy steel conforming to AWWA C111.

## **2.10 CEMENT MORTAR LINING**

- A. Ductile iron pipe and fittings shall be lined with cement mortar in accordance with the requirements of the AWWA C104 except that the lining thickness shall be not less than 1/8 of an inch. The pipe interior surfaces shall be smooth and free from fractures, excessive crazing, and roughness.

## **2.11 THRUST BLOCKS/ RESTRAINTS**

- A. All buried ductile iron pipe and fittings shall have restrained joints. However, thrust blocks and joint restraints are required at each of the three (3) 45 degree bends where the new pipes connect to the existing pipes. Provide concrete thrust blocks at those three (3) elbows per Saratoga Springs Standard Detail DW-2 Concrete Thrust Blocks.
- B. Joint restraints may be tie rods, **TR Flex piping system as manufactured by US Pipe**, or approved equal, or a **Megalug system as manufactured by EBAA Iron**. Where the required pipeline deflection exceeds the recommended deflection of the TR Flex piping system, CONTRACTOR shall use Megalugs to achieve specified deflections.
- C. "RJ MJ" means "Restrained Joint Mechanical Joint" piping with Megalugs (or ENGINEER approved equal) to provide restraint.
- D. Restrained joints shall be suitable for 350 psi test pressures.

## 2.12 SAFETY TAPE

- A. Safety tape shall be a minimum of 3-inch wide by 5.0 mil overall thickness, with no less than a 0.35 gauge solid aluminum foil core. It shall be Safety Blue in color per American Public Works Association (APWA) National Color Code and shall be clearly labeled with the words "CAUTION WATER LINE BELOW" or similar wording approved by ENGINEER. Safety tape shall be **MagnaTec by Empire Level Mfg Corp**, or approved equal.

## 2.13 TRACER WIRE

- A. All piping (including service lines) shall be installed with 14 gauge solid copper THHN tracer wire for pipeline location purposes by means of an electronic line tracer.
  - 1. The wires must be installed along the entire length of the pipe at the top centerline of the pipe and be held in place with poly tape at all pipe joints and at 5 foot intervals.
  - 2. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

## 2.14 PIPE COATINGS

- A. All exposed piping, valves, and fittings including inside vaults and buildings shall be coated as specified in Section 09 90 00 – Painting and Finishes. Exposed piping, valves, and fittings to be painted shall be primed by the manufacturer in preparation for painting. CONTRACTOR shall provide verification from the finish coating supplier that the field applied coatings are compatible with the manufacturer's prime coat. Pipe to be painted shall not have asphalt emulsion coating. The exterior of buried pipe and fittings shall be an asphaltic coating approximately one-mil thick.

## 2.15 COLD-APPLIED WAX TAPE COATING

- A. Apply wax tape coating over all buried flanges, dismantling joints, mechanical joints, Megalug joints, valves, actuators, joints, nuts, bolts, and all metallic appurtenances which are buried.
- B. Primer: Primer shall be a blend of petrolatums, plasticizers, and corrosion inhibitors having a paste-like consistency. The primer shall have the following properties:
  - 1. Color                      Brown
  - 2. Pour Point                100°F to 110°F
  - 3. Flash Point               350°F
  - 4. Coverage                 1 gallon/100 square feet
  - 5. Manufacturer            **Trenton Wax Tape Primer, Denso Paste Primer**, or approved equal.
- C. Wax Tape: Wax tape shall consist of a synthetic-fiber felt, saturated with a blend of microcrystalline wax, petrolatums, plasticizers, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces. The tape shall have the following properties:
  - 1. Color                      Brown
  - 2. Saturant Pour Point      115°F to 120°F
  - 3. Thickness                 50 to 70 mils



- |                        |  |
|------------------------|--|
| 4. Tape Width          | 6 inches   |
| 5. Dielectric Strength | 100 volts/mil  |
| 6. Manufacturer        | <b>Trenton No. 1 Wax Tape, Denso "Densyl Tape", or approved equal.</b> |

- D. Plastic Wrapper: Wrapper shall be a polyvinylidene chloride plastic with three 50-gauge plies wound together as a single sheet. The wrapper shall have the following properties:

- |                 |   |
|-----------------|---|
| 1. Color        | Clear   |
| 2. Thickness    | 1.5 mils  |
| 3. Tape Width   | 6 inches  |
| 4. Manufacturer | <b>Trenton Poly-Ply, Denso Tape PVC Self-Adhesive, or approved equal.</b> |

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.
- B. Ductile iron fittings shall be installed in accordance with the ANSI/AWWA C600. Inspect each pipe and fitting prior to installation to verify there is no damage and clean each pipe and fitting prior to installation.
- C. Pipe shall be laid directly on the bedding material. Bell holes shall be formed at the ends of the pipe to prevent point loading.
- D. No pipe shall be installed on a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation before backfilling occurs.
- E. Immediately before joining the pipe, the bell end of the pipe shall be thoroughly cleaned. The spigot end of the pipe and the inside surface of the gasket shall be cleaned and lubricated. The lubricant shall be non-toxic, shall not support bacteria growth, shall not be harmful to the gasket material, and shall be compliant with NSF/ANSI 61 requirements. The lubricant shall not impart a taste or odor to the water in the pipe. Tilting of the pipe to insert the spigot into the bell will not be permitted.
- F. Buried Ductile Iron pipe shall be polyethylene encased in accordance with the requirements of AWWA C105 Method A. Remove all lumps of clay, mud, cinders, etc. on the pipe surface before installation of the encasement. During installation, soil or embedment material shall not be trapped between the pipe and the polyethylene. Cut polyethylene tube to a length at least 2 feet longer than the pipe section. Wrap shall overlap the adjacent pipe joint at least 1 foot. After assembling the pipe joint, overlap the joint with the polyethylene tube and secure to the pipe with adhesive tape completely around the seam. Overlap the joint on the previous pipe with the polyethylene tube and secure to the existing wrap with adhesive tape and completely seal the seam. Take up the slack width at the top of the pipe to make a snug but not tight fit along the barrel of the pipe and secure with poly tape at 5 foot intervals. For installations below the water table or wet areas, circumferential wraps of tape should be placed at 2 foot intervals along the barrel of the pipe prior to lowering the pipe into the trench.

- G. **DO NOT coat buried bolted joints and valves with food grade grease. Use the wax tape coat system shown above** . After installing the wax coating, encase with polyethylene wrap and install in conformance with AWWA C105 standards. Tape polyethylene seams with **Polyken #900, 3M Scotchrap 51**, adhesive tape, or approved equal, to completely seal the seam.
- H. Repair punctures to the polyethylene wrap with adhesive tape. Repair cuts, tears, or damage to the polyethylene wrap with a tube cut open, wrapped around the pipe to cover the damaged area, and secure in place with **Polyken #900, 3M Scotchrap 51**, adhesive tape, or approved equal, to completely seal the seam.
- I. Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by cutting an "X" in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance, and repair the cut and any other damaged areas.
- J. To make a direct tap, apply two or three wraps of adhesive tape completely around the polyethylene encased pipe to cover the area where the tapping machine and chain will be mounted. Install the corporation stop directly through the tape and polyethylene encasement. After the direct tap is completed, inspect for damage and repair if needed.
- K. Where polyethylene wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of 3 feet. Secure the end with adhesive tape completely around the seam. Service lines with dissimilar metals shall be wrapped with polyethylene or approved dielectric tape for a minimum clear distance of 3 feet away from the ductile iron pipe.
- L. Valves shall be handled in a manner to prevent damage to any part of the valve. CONTRACTOR shall adjust stem packing and operate each valve prior to installation to ensure proper operation. Valves shall be installed so that the valve stems are plumb and, in the location, indicated on the Contract Drawings.
- M. The pipe shall be plugged at the end of each workday or period of suspension.
- N. Safety tracer tape shall be installed 12-inches (atop pipe zone) above the pipe along the entire length of pipeline.
- O. Bring up tracer wire at valve boxes and fire hydrants as shown on the Contract Drawings. Tracer wire also must be brought up at shut-off valves (see gate valve detail and air valve vault detail) for fire hydrants. When splicing a wire use a greased filled or approved connector. All splices should occur within a valve box. Wire is to be continuous underground. Underground splices may only be used by specific permission of OWNER and must be inspected before backfill.

### 3.2 THRUST BLOCKS

- A. Thrust blocks shall be installed at each of the three (3) 45 degree bends where the new pipes connect to the existing pipes.
- B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

- C. Thrust blocks shall bear against solid undisturbed earth at the side and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.
- D. Thrust blocks shall be sized and constructed per OWNER's Standard Detail DW-2 – Concrete Thrust Blocks.

### **3.3 PRELIMINARY CLEANING AND FLUSHING**

- A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material do not remain in any of the pipeline. If possible, the flushing shall be made with an open pipe end.
- B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

### **3.4 BOLTING PROCEDURES FOR FLANGED JOINTS**

- A. Flange joints shall be assembled per the gasket manufacturer's instructions and as specified herein. Utilize calibrated bolting equipment capable of applying a measured torque to flange bolts during joining. Bolting patterns, procedures, and bolting equipment data shall be submitted prior to pipe fitting and bolting.
- B. Gaskets, bolts, and anti-seize lubricant used in the bolting procedure shall be selected from those specified herein. Submit target torque calculations for each application. Calculations shall identify specific gasket (manufacturer, model, size, configuration, material), bolts (size and material), and anti-seize lubricant. The calculations shall document and take into consideration the pipe service, working and test pressures, pipe diameter, gasket data sheet, bolt material, gasket supplier-recommended assembly stress, and gasket-supplier recommended bolt stress. Calculations shall be stamped by a professional engineer. Target torque calculations shall be used in the assembly of bolted joints.
- C. Flange bolts, nuts, and washers shall be visually inspected and cleaned prior to bolting. Lubricate bolts and nuts; if hardened washers are not used, lubricate the flange surface around the bolt holes. This lubricant must be removed by cleaning solvent prior to applying a coating system. Hand-tighten all nuts and bolts then tighten them to 10 to 20 percent of the target torque. The initial torque shall not exceed 20 percent of the target torque. The bolts shall be tightened according to the pattern included in AWWA Manual M11, Figure 12-3.
- D. For flanges having 4 to 8 bolts there shall be three rounds of tightening, after hand tightening, to 30 percent, 60 percent and then 100 percent of the target torque. For flanges having 12 or more bolts there shall be four rounds of tightening, after hand tightening, to 20 percent, 40 percent, 80 percent and 100 percent of the target torque. At 100 percent of target torque the flange gap shall be measured at every other bolt to confirm uniformity. The bolts shall be re-tightened to the target torque 24 hours after completion of the initial bolting sequence.

### 3.5 COLD-APPLIED WAX TAPE COATING APPLICATION

- A. Surfaces shall be clean and free of all dirt, grease, water, and other foreign material prior to the application of the primer and wax tape.
- B. Apply primer by hand or brush to all surfaces of the pipefitting or valve. Work the primer into all crevices and completely cover all exposed metal surfaces.
- C. Apply the wax tape immediately after the primer application. Work the tape into the crevices around fittings. Wrap the wax tape spirally around the pipe and across the fitting. Use a minimum overlap of 55 percent of the tape width.
- D. Work the tape into the crevices and contours of irregularly shaped surfaces and smooth out so that there is a continuous protective layer with no voids or spaces under the tape. For larger voids or irregular shaped surfaces fill spaces with a moldable mastic. Moldable mastic shall be **Trenton Fill-Pro PM-GP**, or approved equal.
- E. Overwrap the completed wax tape installation with the plastic wrapping material. Wrap spirally around the pipe and across the fitting. Use a minimum overlap of 55 percent of the tape width and apply two layers or applications of overwrap. Secure plastic wrapper to pipe with adhesive tape.

### 3.6 TRACER WIRE TESTING

- A. Tracer wire shall be installed where indicated above or shown on the Contract Drawings on the pipe along the entire length of pipeline.
- B. Upon completion of the pipe installation, CONTRACTOR shall demonstrate that the wire is continuous and unbroken through the entire run of the pipe.
  - 1. Demonstration shall include full signal conductivity (including splices) when energizing for the entire run in the presence of OWNER and/or ENGINEER.
  - 2. If the wire is broken, CONTRACTOR shall repair or replace it. Pipeline installation will not be accepted until the wire passes a continuity test.

### 3.7 TESTING OF PIPELINE

- A. CONTRACTOR shall provide additional temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.
- B. Source of Water
  - 1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

### C. Testing Procedure

1. Pipe shall be tested at a static pressure of 200 psi for 2 hours and in accordance with the AWWA C600 standards. Pipe shall be tested in segments such that the test pressure at the low point of the segment shall be 200 psi, and the minimum pressure at the high point in the segment shall be 200 psi.
2. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall repeat the pipeline test, all at no additional cost to OWNER.
3. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

### D. Pressure and Leak Test

1. CONTRACTOR shall test all piping either in sections or as a unit. The test shall be made by placing temporary bulkheads as needed in the pipe and filling the line slowly with water. Care shall be taken to see that all air vents are open during the filling. Bulkheads, valves, and connections shall be examined for leaks. If any leaks are found, corrective measures satisfactory to ENGINEER shall be taken. The test shall consist of holding a minimum pressure as shown on the Drawings in the section being tested for a minimum period of two hours using either pneumatic or hydraulic means to maintain the pressure. Suitable means shall be provided by CONTRACTOR for determining the quantity of water lost by leakage under the test pressure. The testing allowance is defined as the quantity of water that must be applied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. The maximum allowable leakage shall be defined as follows:

$$L = SD(P)^{1/2}/148,000$$

L = Testing allowance (makeup water) in gallons per hour of test

S = Length of pipe in feet

D = Nominal diameter of pipe in inches

P = Average Test Pressure in pounds per square inch (gauge)

## 3.8 DISINFECTING

- A. Disinfection shall be in accordance with Section 33 13 00 – Pipeline Testing and Disinfection.

## 3.9 PAINTING

- A. All exposed piping including inside vaults shall be painted as specified in Section 09 90 00 – Painting and Finishes.

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**SECTION 33 05 07.1**  
**POLYVINYL CHLORIDE (PVC) PRESSURE PIPE**  
**(ASTM D 1785, modified)**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall furnish and install all PVC pressure pipe and appurtenances as shown and specified, and as required for a complete and workable piping system.
- B. This Section includes PVC pressure pipe with solvent-welded, flanged, or threaded joints in accordance with ASTM D 1785 as modified herein. PVC pipe with bell and spigot joints is included in Section 33 05 07 - PVC Pressure Pipe, Rubber Joints (AWWA C900 and C905).

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 05 45 00 Mechanical Metal Supports
  - 3. Section 31 23 15 Excavation and Backfill for Pipelines
  - 4. Section 33 05 07 PVC Pressure Pipe, Rubber Joints (AWWA C900 and C905)
  - 5. Section 33 12 00 Mechanical Appurtenances
  - 6. Section 33 13 00 Pipeline Testing and Disinfection

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
  - 1. ANSI B 16.5 Pipe Flanges and Flanged Fittings Class 150
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM D 1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
  - 2. ASTM D 2467 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
  - 3. ASTM F 1498 Standard Specification for Taper Pipe Threads 60 Degrees for Thermoplastic Pipe and Fittings
- D. AMERICAN WATER WORKS ASSOCIATION (AWWA)
  - 1. AWWA C 605 Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
  - 2. AWWA C 651 Standard for Disinfecting Water Mains

3. AWWA C 900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch for Water Transmission and Distribution
4. AWWA C 905 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14-Inch through 48-inch
5. AWWA M 23 Manual of Water Supply Practices - PVC Pipe - Design and Installation

#### **1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.
- C. Submit shop drawings of pipe, fittings, and appurtenances showing compliance with this Section; and manufacturer's literature on tracer wire and accessories.
- D. Submit plan for commissioning the waterline, including but not limited to cleaning, pressure testing, and disinfection.

### **PART 2 PRODUCTS**

#### **2.1 POLYVINYL CHLORIDE PIPE**

- A. PVC pipe shall be made from new rigid unplasticized polyvinyl chloride and shall be normal impact Type 1, Grade 1, class 12454, listed as compliant with NSF Standard 61, unless otherwise indicated, in accordance with ASTM D 1785.
- B. Pipe sections shall be clearly marked to:
  1. Identify manufacturer's name or trademark
  2. Nominal pipe size and OD base
  3. ASTM material code designation
  4. Schedule
  5. Pressure class
  6. ASTM specification designation
  7. Product record code
- C. The PVC pipe shall be Schedule 80. .

#### **2.2 PIPE JOINTS**

- A. Pipe joints shall be solvent-welded type with solvent cement and primer as recommended by the pipe manufacturer for the chemical in the pipe.
- B. Threaded joints that are necessary to match up to threaded valves or fittings shall be made up with appropriate thread sealant, either paste or tape.
- C. Flanged joints shall be made with solvent-welded PVC flanges, drilled to ASME B 16.5 - Pipe Flanges and Flanged Fittings, Class 150, unless otherwise indicated. Gaskets



shall be ANSI 150 lb. full face, 1/8-inch thick Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service.

## **2.3 FITTINGS**

- A. Solvent-welded and threaded fittings shall be Schedule 80 PVC fittings in accordance with ASTM D 2467 - Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- B. Flanged fittings shall be Schedule 80 fabricated PVC fittings with 150 lb. flanges to ASME B 16.5.

## **2.4 TRACER WIRE**

- A. All buried piping (including service lines) shall be installed with 12 gauge solid copper THHN tracer wire for pipeline location purposes by means of an electronic line tracer.
  - 1. The wires must be installed along the entire length of the pipe on the top of the pipe and be held in place with ties or hitches spaced not more than 12-feet apart.
  - 2. Sections of wire shall be spliced together using approved splice caps and waterproof seals or solder. Twisting the wires together is not acceptable.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.
- B. PVC pipe shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipe shall afford maximum headroom and access to equipment, and where necessary, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.
- C. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00 – Mechanical Metal Supports (Pipe Supports). Where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature changes.
- D. Unless otherwise indicated, connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection. Valves and flanges attached to PVC pipe shall be provided with adequate supports.

## **3.2 PIPE PREPARATION**

- A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. Ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly

### **3.3 PIPE JOINTS**

- A. Pipe threads shall conform to ASTM F 1498 and shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape or thread sealant.
- B. Solvent-welded joints shall be made with fresh primer and solvent cement on clean, dry pipe ends. The primer and cement cans shall be kept closed at all times and the joints shall be made up at the recommended ambient temperatures, according to the pipe or cement manufacturer's written recommendations. Pipe ends shall be inserted to the full depth of the socket. Solvents used on potable water pipes shall be ANSI/NSF 61 certified.
- C. Flanged joints shall be made with gaskets and Type 316 stainless steel bolts and nuts, unless noted otherwise. Care shall be taken not to over-torque the bolts, in accordance with the manufacturer's written recommendations.

### **3.4 PRELIMINARY CLEANING AND FLUSHING**

- A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to insure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible the flushing shall be made with an open pipe end.
- B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

### **3.5 TRACER WIRE TESTING**

- A. Upon completion of the pipe installation, CONTRACTOR shall demonstrate that the wire is continuous and unbroken through the entire run of the pipe.
  - 1. Demonstration shall include full signal conductivity (including splices) when energizing for the entire run in the presence of OWNER OR ENGINEER.
  - 2. If the wire is broken, CONTRACTOR shall repair or replace it. Pipeline installation will not be accepted until the wire passes a continuity test.

### **3.6 INSPECTION AND TESTING OF PIPELINE**

- A. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.
- B. Source of Water
  - 1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.
- C. Testing Procedure
  - 1. CONTRACTOR shall allow adequate time for the solvent cement joints to cure. Curing time shall be per the solvent cement manufacturer's recommendation. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Contract Drawings, for a period of not less than one hour, without exceeding the

tolerances listed on the Contract Drawings. Caution - Do not use air or gas for testing PVC pipe. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices

2. In Leakage shall be determined by loss of pressure. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
3. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.
4. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

### **3.7 DISINFECTING**

- A. Disinfection shall be in accordance with Section 33 13 00 – Pipeline Testing and Disinfection.

- END OF SECTION –

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**SECTION 33 05 13**  
**PRECAST CONCRETE MANHOLES AND STRUCTURES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. CONTRACTOR shall provide precast concrete manholes and vaults, complete and in place, in accordance with the Contract Documents.

**1.2 RELATED WORK**

- A. Related Work specified in other sections includes, but is not limited to:

- |                       |  |
|-----------------------|--|
| 1. Section 01 33 00   | Submittal Procedures                         |
| 2. Section 01 45 00   | Quality Control and Materials Testing        |
| 3. Section 01 60 00   | Product Requirements                         |
| 4. Section 31 23 15   | Excavation and Backfill for Buried Pipelines |
| 5. Section 31 23 23   | Excavation and Backfill for Structures       |
| 6. Section 33 05 05   | Ductile Iron Pipe                            |
| 7. Section 33 05 07   | Polyvinyl Chloride (PVC) Pipe                |
| 8. Section 33 05 07.2 | PVC Sewer Pipe                               |

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

- |                |  |
|----------------|--|
| 1. ASTM A 48   | Standard Specification for Gray Iron Castings  |
| 2. ASTM A 536  | Standard Specification for Ductile Iron Castings   |
| 3. ASTM A 615  | Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement                                       |
| 4. ASTM C 150  | Standard Specification for Portland Cement   |
| 5. ASTM C 478  | Standard Specification for Precast Reinforced Concrete Manhole Sections  |
| 6. ASTM C 497  | Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile   |
| 7. ASTM C 857  | Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures                      |
| 8. ASTM C 858  | Standard Specification for Underground Precast Concrete Utility Structures   |
| 9. ASTM C 913  | Standard Specification for Precast Concrete Water and Wastewater Structures  |
| 10. ASTM C 923 | Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.              |
| 11. ASTM C 990 | Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants. |

## 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate manhole and concrete structure locations, elevations, and piping sizes, material, and elevations of penetrations.
- C. Product Data: Submit cover and frame construction, features, configuration and dimensions. Submit pipe connector materials and dimensions. Submit manhole step materials and dimensions. Submit manhole and structure joint sealant materials.

## 1.5 QUALITY ASSURANCE

- A. CONTRACTOR shall demonstrate that manholes and structures have been properly installed, level, with tight joints, at correct elevations and orientations, and have been backfilled and compacted in accordance with the specifications.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.
- C. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

## PART 2 PRODUCTS

### 2.1 MANHOLES

- A. Reinforced precast concrete manholes in accordance with ASTM C 478 with HS-20 loading. Axial length of barrel sections shall be selected to provide the correct total height with the fewest joints. Conical sections shall be designed to support cast iron frames and covers under H-20 loading, unless noted otherwise. Design criteria shall be as shown on the Contract Drawings. Manholes shall be manufactured by **Oldcastle Precast, Geneva Pipe and Precast**, or approved equal.
- B. Joints shall be sealed with butyl-rubber sealants, **ConSeal CS-102, Ram-Nek RN101**, or approved equal, conformation to ASTM C 990. Wrap exterior section joints with membrane waterproofing and exterior joint wrap meeting the requirements of ASTM C877, Type III, **Marmac, Conseal CS212, or Press-Seal Corp EA-Wrap**, or approved equal.
- C. Barrel section to pipe connections shall be sealed with resilient connectors, **Kor-N-Seal by Trelleborg**, or approved equal, complying with ASTM C 923. Mechanical devices shall be stainless steel.

## 2.2 STRUCTURES

- A. Provide reinforced concrete structures and vaults designed for the applications and sizes as shown on the drawings. Structures shall conform to the requirements of ASTM C 857, ASTM C 858, or ASTM C 913 as required. Minimum wall thickness shall be 5-inches. Cement shall be Type V Portland cement conforming to the requirements of ASTM C 150. The minimum 28-day concrete compressive strength shall be 4,000 psi. Reinforcing steel shall be embedded in the concrete with a minimum rebar clear cover as recommended by ACI 318. Structure and vaults shall be manufactured by **Oldcastle Precast, Geneva Pipe and Precast**, or approved equal
- B. Structures in areas subject to traffic shall be designed for H-20 traffic loading. Vaults in other areas shall be designed for a vertical live load of 300 psf.
- C. Where joints are required, joints shall be interlocking to secure proper alignment between members and shall prevent migration of soil through the joint. Joints shall be sealed with butyl-rubber sealants, **ConSeal CS-102, Ram-Nek RN101**, or approved equal, conformation to ASTM C 990.
- D. Openings, where required, shall be of the size and location indicated on the drawings and shall be provided without obstructions from brackets and supports. Unless noted otherwise, frames and covers shall be fabricated from steel and galvanized after fabrication. Frames shall be integrally cast into the structure concrete sections. Covers shall be tight fitting to prevent dirt and debris entering the structure.
- E. Where penetrations are required for piping, conduits, or ducts, such penetrations shall be through precast openings or core drilled through unreinforced thin-wall knock-out sections. Penetrations shall be smooth and exposed reinforcing steel will not be allowed. Unless noted otherwise, structures do not need to be designed to resist thrust from piping passing through the structure.

## 2.3 FRAMES AND COVERS

- A. Manufacturers:
  - 1. **D & L Foundry and Supply, East Jordan Iron Works, Neenah Foundry Co.**, or approved equal. Model Number as shown on the Drawings.
- B. Product Description: Casting frames and covers shall be non-rocking and shall conform to the requirements of ASTM A 48, Class 35B for Gray Iron and ASTM A 536 for ductile iron. Unless noted otherwise, cast iron covers and frames shall be 30-inches in diameter, machined flat bearing surface, removable lid; HS-20 load rating; with embossed lettering saying ("IRRIGATION", "WATER", "SEWER", "STORM DRAIN") cast into cover.

## 2.4 COMPONENTS

- A. Manhole and Structure Steps shall have a 1/2-inch ASTM A 615 grade 60 steel reinforcement rod encased in polypropylene copolymer plastic. Steps shall have a tread width of 14-inches nominal. Steps shall be manufactured by **American Step Company, Inc., M.A. Industries**, or approved equal.

## **2.5 CONFIGURATION**

- A. Shaft Construction: Square or rectangular with flat lid top section; lipped male/female joints; shaped to receive pipe sections.
- B. Clear Inside Dimensions: As indicated on Drawings.
- C. Design Depth: As indicated on Drawings.
- D. Clear Cover Opening: As indicated on Drawings.

## **2.6 BEDDING AND COVER MATERIALS**

- A. Bedding: 3/4" Washed Rock as specified in Section 31 23 23.
- B. Soil Backfill to Finish Grade: Trench Backfill Material as specified in Section 31 23 15.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify built-in items are in proper location, and ready for roughing into Work.
- C. Verify correct size of manhole and structure excavation.

### **3.2 PREPARATION**

- A. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- B. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

### **3.3 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION**

- A. Lift precast components at lifting points designated by manufacturer.
- B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 23.
- D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.



- F. Joint sealing materials may be installed on site or at manufacturer's plant.
- G. Verify manholes and structures installed satisfy required alignment and grade.
- H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe.
- I. Steps shall be installed 12-inches on centers vertically not more than 1/2-inch out of plumb. The top step shall not be more than 12-inches below the manhole cover.
- J. Prior to backfilling, fill all cracks and voids in the manholes or vaults with non-shrink grout, polyurethane sealant, or both.

### **3.4 FRAME AND COVER INSTALLATION**

- A. Set frame and cover 2-inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1-inch below top surface of frame.
- B. In paved areas set frame and cover 1/4" below finished grade and install concrete collar.

### **3.5 FIELD QUALITY CONTROL**

- A. Section 01 45 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Vertical Adjustment of Existing Manholes and Structures
  - 1. Where required, adjust top elevation of manholes and structures to finished grades shown on Drawings.
  - 2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.

- END OF SECTION -

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**SECTION 33 05 26**  
**UTILITY IDENTIFICATION**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. The CONTRACTOR shall provide and install identification markers for all exposed valves, piping, equipment, tanks, and warning signs, all in accordance with these specifications and the Contract Documents.

**1.2 RELATED WORK**

- A. Related work specified in other sections includes:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 09 90 00 Painting and Finishes

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
  - 1. ANSI A13.1 Scheme for the Identification of Piping Systems
  - 2. ANSI Z535 Safety Signs and Colors
- C. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)
  - 1. ASTM D 1593 Standard Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting
  - 2. ASTM D 3652 Standard Test Method for Thickness of Pressure-Sensitive Tapes

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit manufacturer's data sheets showing wording, symbols, letter size, and color coding.
- C. Submit one sample of each type of identification device to be used.
- D. Submit sample of each proposed color required by the color schedule.
- E. Submit the manufacturer's installation instructions.

**1.5 QUALITY ASSURANCE**

- A. Product manufacturer shall be ISO 9001 Quality Certified.

## PART 2 PRODUCTS

### 2.1 VALVE TAGS

- A. General: Provide each valve of size 2-inch and larger with an identification tag. Tag shall show the pipeline station (if applicable), type, manufacturer, date of manufacture, and pressure rating.
- B. Plastic Tags:
  - 1. Acrylic: Flexible 0.060-inch (1.52 mm) thick, multi-layered acrylic engraved tags. Model **Setonply by Seton, B-418 by Brady**, or approved equal.
- C. Metal Tags:
  - 1. Brass: 19 gauge thick solid brass, with 3/16-inch (5 mm) top hole for fastener, natural brass finish. Manufacturer shall be **Seton, Brady**, or approved equal.
  - 2. Aluminum: 19 gauge thick aluminum. Teflon coated both sides, with Code 39 bar codes. Manufacturer shall be Seton, Brady, or approved equal.
  - 3. Stainless Steel: 0.6 mm (0.025 inch) thick, Grade 304 stainless steel. Manufacturer shall be **Seton, Brady**, or approved equal.
  - 4. Lettering: stamped or engraved letters; character size and words according to ANSI A13.1.
- D. Beaded Chains: No. 6 (brass or nickel over steel, or stainless steel, 114 mm (4-1/2 inch) long, with locking link.
- E. OR Nylon Ties: 150 mm (min), 6 to 10 inches long, nonconductive.
- F. Chart: Typewritten letter size list in anodized aluminum frame.

### 2.2 PIPE MARKERS

- A. General: Labels for piping shall bear the full piping system name. Provide flow arrows and working pressure next to each label.
- B. Mechanically Fastened Pipe Markers:
  - 1. Vinyl: Factory fabricated vinyl, 0.020 inch to 0.030 inch thick, performed to fit around pipe or pipe covering. Model **Setmark by Seton, B-915 Brady SnapOn Vinyl by Brady**, or approved equal.
  - 2. Polyester: Factory fabricated polyester, 0.1 mm (4 mil) thick, laminated with UV-resistant poly vinyl fluoride (PVF), preformed to fit around pipe or pipe covering. Model **Ultramark by Seton, B-689 High Performance by Brady**, or approved equal.
- C. Self-Adhesive Pipe Markers:

1. Vinyl: Factory fabricated vinyl, 0.102 mm (5 mil) thick, preformed to fit around pipe or pipe covering. Model **Opti-Code by Seton, B-946 by Brady**, or approved equal.
  2. Polyester: Factory fabricated polyester, 0.05 mm (2 mil) thick, coated with acrylic adhesive. Model **Poly-Code by Seton**, or approved equal.
  3. Plastic: Factory fabricated plastic film, roll formed, clear laminated to protect lettering.
- D. Nylon Ties: 150 mm (min), 6 to 10 inches long, nonconductive.
- E. Identify fluid being conveyed and include flow direction arrow.
1. Language: English.
  2. Lettering: Size and Color according to ANSI A 13.1.
- F. Color and Text per the Schedule at the end of this Section.

## 2.3 LABELS FOR EQUIPMENT AND TANKS

- A. Provide a label for each piece of mechanical equipment and/or tank. The label shall contain the equipment name, tag number, and identifying information such as size, liquid, horsepower, etc. Minimum label size shall be 1-1/2 inches by 4-inches. Labels shall be stainless steel, brass, or aluminum. Fiberglass labels may be used for corrosive environments. Manufacturer shall be **Brady, Seton**, or approved equal.

## 2.4 LABELS FOR AUTOMATIC START/STOP EQUIPMENT

- A. Provide a sign reading "CAUTION – EQUIPMENT STARTS AND STOPS AUTOMATICALLY" on equipment as shown on the drawings on identified in the specifications. Signs shall be vinyl with self-adhesive for application to the equipment. Minimum size shall be 7-inches by 10-inches. Manufacturer shall be **Brady, Seton**, or approved equal.

## 2.5 WARNING SIGNS

- A. Provide a properly labeled, rigid warning sign as shown on the drawings. Signs shall contain the header, pictogram/alert symbol, and messaging conforming to OSHA/ANSI A 535 requirements. Minimum size shall be 7-inch high by 10-inch wide. Signs shall be plastic with overlamine and be pre-drilled for mounting. Manufacturer shall be **Seton, Brady**, or approved equal.

# PART 3 EXECUTION

## 3.1 GENERAL

- A. Markers and identification tags shall be installed in accordance with the manufacturer's printed instructions and shall be neat and uniform in appearance. Tags and markers shall be readily visible from all normal working locations.

## 3.2 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### **3.3 INSTALLATION**

#### **A. Valve Tags:**

1. Install tags with corrosion resistant chains or ties.
2. Identify valves in main and branch piping with tags.
3. Identify small devices, such as in-line pumps, with tags.
4. Tag automatic controls, instruments, and relays.

#### **B. Pipe Markers:**

1. Identify all above grade piping. Include service, flow direction, and working pressure.
2. Provide snap-on type markers for pipes 6-inch diameter and smaller. Provide strap-on type for pipes over 6-inch diameter.
3. Each pipe shall be marked at:
  - a. Intervals of 20-feet in straight runs.
  - b. At least once in every room.
  - c. Within 2 –feet of bends and valves.
  - d. On the upstream side of Tees, branches, and other distribution points.
  - e. On both sides of walls and floors through which the piping passes.

#### **C. Automatic Start/Stop Equipment**

1. Attach signs for exposed equipment directly to the equipment.
2. Attach signs for sump pumps on the adjacent wall.

#### **D. Warning Signs**

1. Attach to walls according to the manufacturer's recommendations.

#### **E. Equipment and Tank Labels**

1. Attach labels to equipment with a pop rivet or equal.

### 3.4 SCHEDULES

Color Schedule				
Pipe Contents		Pipe Color	Marker Color	Letter Color
Abbreviation	Identification			
AHP	Air, High Pressure	Dark Green	Blue	White
AI	Air, Instrument	Dark Green	Blue	White
CL	Chlorine (gas or liquid state)	Yellow	Orange	Black
CLS	Chlorine Solution	Yellow	Orange	Black
CLV	Chlorine Gas Under Vacuum	Yellow	Orange	Black
CV	Chlorine Vent & Detection Line	Yellow	Orange	Black
EE	Engine Exhaust		Yellow	Black
EWR	Engine Cooling Water Return		Green	White
EWS	Engine Cooling Water Supply		Green	White
FL	Fluoride	Light Blue/Red	Orange	Black
FOR	Fuel Oil Return		Brown	White
FOS	Fuel Oil Supply		Brown	White
FSP	Fire Protection Sprinkler System	Red	Red	White
HWR	Domestic Hot Water Return		Yellow	Black
HWS	Domestic Hot Water Supply		Yellow	Black
LSS	Landscape Sprinkler System		Green	White
NG	Natural Gas	Org-Red/Black	Yellow	Black
OF	Overflow		Green	White
PD	Plant Drain	Green	Green	White
PPS	Pump Suction (Potable Water)	Light Blue	Green	White
PTW	Pump to Waste	Green	Yellow	Black
PW	Potable Water	Dark Blue	Green	White
RS	Raw Sludge	Black	Yellow	Black
RWL	Rain Water Leader		Green	White
RW	Raw Water	Olive Green	Green	White
SA	Sample Line		Yellow	Black
SD	Sanitary Drains	Dark Gray	Yellow	Black
SDR	Storm Drain	Green	Green	White
SL	Sludge	Dark Brown	Yellow	Black
SUC	Structure Underdrain Collector		Green	White
UW	Utility Water (Non-Potable Water)	Magenta	Yellow	Black
V	Vent	Dark Brown	Yellow	Black

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**SECTION 33 12 00**  
**MECHANICAL APPURTENANCES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. CONTRACTOR shall furnish and install all valves, and equipment, complete and operable in accordance with the Specifications. All system components shall be rated to max system pressure or higher.
- B. Where 2 or more valves or equipment of the same type and size are required, the valves shall be furnished by the same manufacturer.
- C. CONTRACTOR shall verify that flanges on pipe match the bolt hole pattern of the flanges on the mechanical appurtenances.
- D. All appurtenances shall be NSF 61 certified if used in potable water systems.
- E. Unless noted otherwise below or on the Contract Drawings, all system components shall be rated for the maximum system pressure or higher.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 01 45 00 Quality Control & Materials Testing
  - 3. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
  - 4. Section 31 23 15 Excavation and Backfill for Buried Pipelines
  - 5. Section 31 23 23 Excavation and Backfill for Structures
  - 6. Section 33 05 05 Ductile Iron Pipe and Fittings
  - 7. Section 33 05 07.1 Polyvinyl Chloride (PVC) Pressure Pipe (ASTM D 1785)
  - 8. Section 33 92 10 Steel Pipe, Specials, and Fittings (AWWA C200, modified)

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of these Specifications to the extent referenced. The publications are referred to in the text to by basic designation only.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. A 126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
  - 2. A 216 Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
  - 3. B 584 Standard Specification for Copper Alloy Sand Castings for General Applications

C. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. C 504 Rubber-Seated Butterfly Valves, 3-inch through 72-inch
2. C509 Resilient-Seated Gate Valves for Water Supply Service
3. C512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
4. C 515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
5. C 518 Dual-Disc Swing-Check Valves for Waterworks Service
6. C 550 Protective Interior Coatings for Valves and Hydrants

D. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. B 16.1 Gray Iron Pipe Flanges and Flanged Fittings
2. B 16.34 Valves – Flanged, Threaded, and Welding End

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit catalog cut sheets on all mechanical appurtenances including fittings, valves, or other items shown on the Contract Drawings referencing each item by mark number. Information shall indicate manufacturer specification compliance, Cv factor, pressure rating, and dimensional data. Indicate NSF 61 compliance of all appurtenances and valves.

**PART 2 PRODUCTS**

**2.1 GATE VALVES**

- A. Gate valves shall conform to the requirements of AWWA C-509 or C-515. Valves shall be of the resilient-seat type with non-rising stem (NRS), opening to the left, and provided with a 2-inch square operating nut for buried valves or hand wheel for valves located in structures. Buried valves shall be of flange or mechanical joint design to match pipe joint system.
- B. Valves, valve-operating units, stem extensions and other accessories shall be installed by CONTRACTOR where shown, or where required in the opinion of ENGINEER, to provide for convenience in operation. Where buried valves are indicated, CONTRACTOR shall furnish and install valve boxes to 3-inches above grade in unimproved areas or at grade with concrete collar in improved areas. All valves and gates shall be new and of current manufacture.
- C. The valve shall have a two-part thermosetting or fusion bonded epoxy protective coating (10 mil minimum inside and out) system that is non-toxic and imparts no taste to water. The epoxy shall be applied in accordance with AWWA C550 and be ANSI/NSF 61 certified.
- D. The flanges of valves may be raised or plain faced. Flanges of valves shall be faced and drilled to 125-lb American Standard template. Provide ASME Class 250 flanges for valves located on the high pressure discharge side piping.

- E. All valves shall be furnished with pressure classes equal to or better than the pressure class of the pipe with which the valves are to be used. Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure. Certify valves have zero leakage across closed valve during a 250 psi test.
- F. Valves shall be manufactured by **Mueller Co., Clow Valve Co., American Flow Control**, or approved equal.

## 2.2 DOUBLE ECCENTRIC BUTTERFLY VALVES

- A. Butterfly valves shall be double eccentric type - so that EPDM seat is not in compression to any degree except at full closure – shall be rated for 250 psi and 16 fps velocity (min), certified compliant with AWWA C504 Class 150B and NSF 61, with 2-flanges (ANSI B16.1 Class 150B drilled), ductile iron body tested to 400 psi. All bolting shall be 316 SS.
- B. Zero Leakage Seats. Provide EPDM seat clamped to disc by continuous 316 SS ring. Resilient seats shall be field replaceable without special tools or epoxy. Body seat shall be 316 SS welded to, or mounted on, valve body. *Certify valves have zero leakage across closed valve during a 250 psi test in both directions.*
- C. Line and coat all iron parts of valve with 10 mils min of polyamide cured epoxy or fusion bonded epoxy in accordance with AWWA C550.
- D. Provide dry shaft design with double O-ring seal on shafts that keep water out of disc portion and body portion of shaft. O-ring seals shall be replaceable without removing shaft from valve. Provide shaft bearings of self-lubricating sleeve type made of bronze.
- E. Provide AWWA C540 compliant actuator, rated at 450 ft lbs torque, with integral disc position indicator and self-locking worm gear that holds disc in any position without creep or flutter. Provide handwheel with each valve.
- F. Where shown on the Contract Drawings valves shall be electrically actuated rated for continuous modulation at voltage provided. See Section 40 92 57 Electric Motor Actuators.
- G. Provide 1-year warrantee against manufacturer defects, with labor replacement costs.
- H. Double eccentric butterfly valves shall be **Av-Tek, VAG, AVK**, or approved equal

## 2.3 BALL VALVES

- A. Valves shall be rated for the working pressure of the system. Valves for use in potable water systems shall be NSF 61 certified.
- B. **Stainless Steel Ball Valves** shall be full port opening stainless steel and have adjustable stem packing gland. Body and ball shall be stainless steel in accordance with ASTM A351. Seats shall be reinforced PTFE and packing stem shall be PTFE. The handle shall be Type 304 stainless steel with vinyl insulator. The valves shall conform to MSS-SP-110 and be **Apollo 76F-100, NIBCO T-585-S6-R-66-LL, Watts Series S-FBV-1**, or approved equal.
- C. **Brass Ball Valves** shall be full port opening brass, blow out proof stem design, adjustable stem packing, secondary O-ring stem seal, zinc plated steel handle with vinyl

insulator. Provide **Apollo Series 64, Watts Series LFB6801, NIBCO FP600A-LF, FNW X410C**, or approved equal.

## **2.4 SERVICE SADDLES**

- A. Shall consist of a 2-piece bronze body and strap, meeting applicable sections of AWWA C800.
- B. Outlet shall be tapped with AWWA I.P. thread (F.I.P.T.). Outlet shall be o ring sealed. Saddles shall be ANSI/NSF 61 certified.
- C. Shall be **Mueller BR2S or BR2W**, no equal.

## **2.5 WATER SERVICE CONNECTIONS AND FITTINGS**

- A. Water service pipe shall be polyethylene tubing (PE 3408 IPS, 200 psi) for buried service lines. Poly piping shall be 3/4-inch, 1-inch or 2-inch minimum as indicated on the Contract Drawings. Replacement service pipes shall be the same diameter as existing pipes.
- B. All water service connections, except 2-inch, shall be made using **Mueller Insta-Tite Connections, Ford Ultra-Tite**, or approved equal, fittings and shall conform to AWWA C800. All 2-inch water service connections shall be made using **Mueller Pack Joint, Ford Pack Joint**, or approved equal.

## **2.6 CORP STOPS**

- A. Corp Stops shall be Brass Alloy 85-5-5-5 ASTM B62 and conform to the requirements of AWWA C800.
- B. Corp Stops for 3/4-inch and 1-inch sizes shall be **Mueller H-15026, Ford F1100 Ultra-Tite joint**, or approved equal.
- C. Corp Stops for 2-inch size shall be **Mueller E-25029, Ford F1100 Pack Joint**, or approved equal.

## **2.7 FIRE HYDRANTS**

- A. Fire hydrants shall the dry-barrel type that meet or exceed ANSI/AWWA C502, latest revision. Rated working pressure shall be 250 psig, test pressure shall be 500 psig.
- B. The nozzle section, upper and lower stand pipes and hydrant base shall be ductile iron.
- C. External surfaces above grade shall be factory coated with an epoxy primer and a two-part polyurethane top coating.
- D. The main valve closure shall be of the compression type, opening against the pressure and closing with the pressure. Nozzle section to be designed for easy 360° rotation by the loosening of no more than four bolts.
- E. The valve opening diameter shall be 5-1/4". Hydrant must be designed so that removal of all working parts can be accomplished without excavating. The bronze seat shall be threaded into mating threads of bronze for easy field repair.

- F. Bolting below-grade shall be stainless steel.
- G. The draining system of the hydrant shall be bronze and be positively activated by the main operating rod. Hydrant to be furnished with a sliding bronze drain valve. Sliding drain valves made of rubber, plastic or leather will not be allowed.
- H. Hydrant must have an internal travel stop nut located in the top housing of the hydrant.
- I. Hydrant operating threads to be factory lubricated. O-rings shall be furnished to help keep operating threads lubricated and protected from line fluid and from the weather.
- J. Hydrant must have a traffic flange design allowing for quick and economical repair of damage resulting from a vehicle's impact. Hydrants shall be **AMERICAN Flow Control's Waterous Pacer Model WB67-250** (NO EQUAL ALLOWED).

## 2.8 VALVE BOXES AND LIDS

- A. All buried valves shall be installed complete with 6-inch diameter slide type, two-piece cast iron valve box. Manufacturer be **Tyler 562 Series**, or approved equal. The valve box lid shall be designated "WATER" unless noted otherwise on the Contract Drawings.
- B. Valves and valve boxes shall be set plumb. Valve boxes shall be centered directly over the valve operating nut. If the top of the valve nut is greater than five (5) feet below finished grade a valve nut extension shall be required. Earth fill shall be carefully tamped around the valve box to a distance of four (4) feet on all sides of the box, or to the undisturbed trench face if less than four (4) feet. Valves shall have the interiors cleaned of all foreign matter before installation.
- C. Road base around the valve box shall be re-compacted, and the concrete collar placed. Valve boxes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement. Valve boxes must be cleaned of all debris after setting of collars.
- D. Concrete Collars shall be 10" thick x 2'- 6" in diameter centered on the valve box. They shall have two circumscribing #4 bars, one at three inches from the outside edge and a second bar nine inches from the outside edge each centered in the concrete. Concrete shall be 3000 psi.

## 2.9 PRESSURE GAUGES

- A. Pressure gauges shall be provided where shown on the Contract Drawings. Gauges shall meet the requirements of ASME B40.1 Grade 2A and be industrial type with stainless steel movement, liquid filled, and stainless steel, Polypropylene, or Phenolic case. Gauges shall have a rear blowout disc or panel. Unless noted otherwise on the Contract Drawings, pressure gauges shall have a 4-1/2-inch dial with white face and black lettering, a 1/2-inch threaded connection, and shut-off valve. Measuring element shall be a stainless steel Bourdon Tube. Gauges shall be calibrated to read in applicable units, with an accuracy of  $\pm 0.5$  percent to 150 percent of the working pressure. Gauges shall be manufactured be **Ashcroft Model 1279 Duragauge Performance Plus1**, , or approved equal.

## 2.10 PRESSURE RELIEF/PRESSURE SUSTAINING VALVE

- A. Pressure Relief/Pressure Sustaining Valve shall be hydraulically operated, pilot-controlled valve designed to open to relieve excess pressure (extremely infrequently) in a pipeline. Valve shall be hydraulically operated, single diaphragm actuated, globe type valve. Valve stem and trim shall be stainless steel and the valve body shall be steel conforming to ASTM A 216, Grade WCB. Ends shall be threaded or Class 300 grooves and shall be rated for a working pressure of 350 psi. The valve manufacturer shall provide a 3-year warranty on valve and 1-year warranty on the electrical components. The pressure relief/pressure sustaining valves shall be **Model 50-01 by Cla-Val Company**, or approved equal. Valve and parts shall be NSF 61 compliant.
- B. The pressure relief pilot shall be a direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked. A full range of spring settings shall be available from 0 to 450 psi.
- C. A direct factory representative shall provide start-up assistance, inspection and adjustments. The representative shall provide 2 to 4 hours of assistance for each valve installed on the project.

## 2.11 RUBBER FLAPPER SWING CHECK VALVES

- A. Provide rubber flapper type swing check valve, 250 psi rated, complying with AWWA C508, with flanges complying with ANSI B16.1, Class 125, having a valve body with full flow area equal to pipe nominal diameter at all points, and a seating surface on a 45-degree angle to minimize disc travel. Provide a stainless steel disc closure accelerator.
- B. Valve body and cover shall be ASTM A536 Grade 65-45-12 ductile iron. Disc shall be precision molded Buna-N (NBR) ASTM D2000-BG. Valve shall be NSF 61 certified.
- C. Check valve shall be **Valmatic Series 7200 Surgebuster**, or approved equal.

## 2.12 DRAIN LINE CHECK VALVE

- A. Drain line check valves shall be the low-head "duck bill" type installed at the locations shown on the drawings. Valves shall be constructed of Rubber, Neoprene, Hypalon, Chlorobutyl, Buna-N, EPDM, Viton and be **Tideflex Model TF-1 by Red Valve**, (no approved equal).

## 2.13 SMALL CHECK VALVES

- A. The globe style check valves shall be **APCO Globe Style Series 600 Silent Check Valves**, or approved equal, and shall be rated at 150 psi.
- B. The 1-inch and 2-inch brass check valves shall be **Watts CVY Series**, or approved equal, with rating 125 WSP/200 WOG.
- C. The 1-inch PVC check valves shall be **Spears Industrial Ball Check Valve Model 4521**, or approved equal, with a pressure rating of 235 psi.

## **2.14 HOSE BIBBS and SAMPLING TAPS**

- A. Hose bibbs shall be as-manufactured by Watts, or approved equal, and shall include an integral vacuum breaker or built-in backflow protection devices and cast iron wheel handle. Sampling Taps shall be smooth nose type. Valves shall be stainless steel.

## **2.15 COMBINATION AIR/VACUUM VALVES**

- A. Combination Air/Vacuum valves shall be single body, double orifice valves conforming to the requirements of AWWA C 512. Valve float shall be stainless steel. Valves shall be the size indicated on the drawings and shall be **Vent-o-Mat**, no equal.

## **2.16 AIR RELEASE VALVES**

- A. Air release valves shall be provided where shown. Valve body shall be ductile iron and float shall be stainless steel and shall conform to the requirements of AWWA C 512. Air release valves on the discharge piping shall be designed for a working pressure of 350 psi. Valves shall be the size indicated on the drawings and shall be **Vent-o-Mat**, no equal.

## **2.17 FLOW METER**

- A. See Section 40 91 23 – Miscellaneous Properties Measurement Devices.

## **2.18 PRESSURE TRANSMITTERS**

- A. See Section 40 91 23 – Miscellaneous Properties Measurement Devices.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- A. Valves, valve-operating units, stem extensions and other accessories shall be installed by CONTRACTOR where shown, or where required in the opinion of ENGINEER, to provide for convenience in operation. Where buried valves are indicated, CONTRACTOR shall furnish and install valve boxes at grade with concrete collars. All valves and boxes shall be new and recently manufactured.
- B. Install mechanical appurtenances as indicated on the Contract Drawings and in accordance with the manufacturer's written instructions.

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**SECTION 33 12 30**  
**PUMP AND PUMP MOTOR**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Furnish, deliver, and install a short set vertical turbine pump and motor, integral suction barrel, F-type discharge head (above ground discharge and below grade suction mounted on the fabricated barrel or can), and appurtenant work, complete and operable, as shown on the Contract Drawings.
- B. CONTRACTOR shall furnish pumps, motors, pump can, discharge head, pump column, and appurtenances for Pumps P-1, P-2, and P-3. CONTRACTOR shall only provide pump cans for Pumps P-4 and P-5. However, ALL pump cans and electrical and control conduits shall be sized, furnished and installed to meet the design criteria for Pumps P-4 and P-5.
- C. The pump manufacturer shall be made responsible for furnishing the Work and for the coordination of design, assembly, testing, and installation of the Work. Contractor shall be responsible to Owner for compliance with the requirements of each pump.
- D. Where 2 or more pumps of the same type or size are required, provide pumps produced by the same manufacturer
- E. All pumps supplied under this specification shall be suitable for pumping culinary water. All material, manufacturing and performance standards shall be in compliance with AWWA E103, NSF 61, and NSF 372 as applicable. Contractor shall submit documentation necessary to verify all comments, materials, and coatings meet these requirements.

**1.2 RELATED WORK**

- A. Related work specified in other sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittals
  - 2. Section 09 90 00 Painting and Finishes
  - 3. Section 33 12 00 Mechanical Appurtenances
  - 4. Section 33 13 00 Pipeline Testing and Disinfection

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
  - 1. ANSI B16.1            Gray Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 36 Standard Specification for Carbon Structural Steel
2. ASTM A 48 Standard Specification for Gray Iron Castings
3. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated, Welded and Seamless
4. ASTM A 108 Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished
5. ASTM A 536 Standard Specification for Ductile Iron Castings
6. ASTM A 582 Standard Specification for Free-Machining Stainless Steel Bars
7. ASTM B 505 Standard Specification for Copper-Alloy Continuous Castings
8. ASTM B 584 Standard Specification for Copper Alloy Sand Castings General Applications

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 651 Standard for Disinfecting Water Mains
2. AWWA E 103 Standard for Horizontal and Vertical Line-Shaft Pumps

E. NSF INTERNATIONAL (NSF)

1. NSF 60 Drinking Water Treatment Chemicals
2. NSF 61 Drinking Water System Components – Health Components
3. NSF 372 Drinking Water System Components – Lead Content

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures. CONTRACTOR shall provide pump curves and data for Pumps P-1, P-2, and P-3 and for Pumps P-4 and P-5 to allow ENGINEER to evaluate the proposed size of the pump cans.
- B. CONTRACTOR shall submit for review to ENGINEER, sufficient literature, detailed specifications, and drawings to show dimensions, make, style, speed, size, type, horsepower, head-capacity, efficiency, materials used, design features, internal construction, weights, and any other information required by ENGINEER for review of all pumping equipment. No pumping equipment will be accepted, and installation will not be allowed, until such review has been completed. All submittals shall clearly state any deviations from the specified requirements. The following shall also be furnished with the submittal:
  1. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. The equipment manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the specified design point.
  2. Discharge Head shop drawing showing material type, diameter, thickness, all applicable dimension; discharge nozzle size and location; and exterior coating and interior lining system.
  3. Suction Can/Barrel shop drawing showing barrel material type, diameter, thickness, all dimensions; suction nozzle size and location; flow vanes material, thickness, size,

- and locations and demonstrate clearance between flow vanes and pump bowls; bolting hole pattern and sizes; and exterior coating and interior lining system.
4. Equipment manufacturer shall provide complete and detailed information regarding the installation of the pumps. Any installation requirements or operating conditions which the supplier or manufacturer considers to be critical to the safe and reliable operation of the pumps should be identified and described in detail.
  5. Shop drawings submitted for review also shall include electrical diagrams, schematic control diagrams, and a detailed description of how the control system is to function.
  6. Submit performance curves at intervals of 100 rpm from minimum speed to maximum speed for each pump equipped with a variable speed drive.
  7. Documents of NSF 61 and 372 status of all components, materials, and coatings used in fabrication and assembly of pumps.
- C. Submit signed, dated, and certified factory test data for each pump which requires factory testing. Submit these data before shipment of equipment.

## **1.5 MECHANICAL DEFECTS AND REJECTIONS**

- A. CONTRACTOR furnished pumps that have mechanical defects or do not meet the requirements for head-capacity, horsepower, efficiency, and vibration requirements will be rejected, and shall be replaced by Contractor without additional cost to OWNER for furnishing, removal, reinstallation, and retesting. Mechanical defects shall include excessive vibration, improper balancing of any rotating parts, improper tolerances, binding, excessive bearing or motor heating, defective materials, including materials that do not conform to the Specifications, improper fitting of parts, and any other defect which will in time damage the pump or unreasonably impair its efficiency or operation.

## **1.6 WARRANTY**

- A. CONTRACTOR furnished equipment covered by these specifications shall be warranted against defective parts due to faulty material or workmanship for one (1) year after date of start-up and acceptance by OWNER. CONTRACTOR shall guarantee to replace any defective parts within the period of time specified at no additional cost to OWNER. If CONTRACTOR has to pull pump to replace defective parts, CONTRACTOR shall guarantee to pull and replace pump at no additional cost to OWNER.

## **1.7 MEASUREMENT AND PAYMENT**

- A. Full compensation for pumps, motors, installation, and testing shall be included in the contract lump sum bid price for the Pumps and Motors.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Compliance with the requirements below may necessitate modifications to the manufacturer's standard equipment.
- B. Unless otherwise noted, the required shaft horsepower for the entire pump assembly at any point on the performance curve shall not exceed the rated horsepower of the motor or encroach on the service factor.

- C. Provide each pump with a stainless steel nameplate indicating serial number(s), rated head and flow, impeller size, pump speed, and manufacturer's name and model number.

## **2.2 FACTORY TESTING**

- A. Equipment shall be factory tested and inspected as specified hereinafter. All costs for the tests shall be borne by CONTRACTOR. Conduct the following tests on each indicated pump system:
  - 1. Non-Witnessed Certified Factory Test
    - a. Perform tests using the complete pump system (excluding the pump barrel) to be furnished, including the project motor and variable speed drive, if equipped with a variable speed drive.
    - b. For pumps with motors smaller than 100 hp, the manufacturer's certified test motor will be accepted.
    - c. Testing of prototype models will not be accepted.
    - d. Pumps shall meet the requirements of HI 14.6 Grade 1U.
    - e. Conduct the following minimum tests and submit the test results:
      - 1) Hydrostatic Test;
      - 2) Performance Test:
        - a) Conduct performance test at maximum speed, obtain a minimum of 5 hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, and record on data sheets as defined by the Hydraulic Institute standards;
        - b) For variable speed pumps, test each pump between maximum and minimum speed at 100 rpm increments (pump affinity calculations only will not be accepted);
        - c) Submit pump curves showing head vs. flow, bhp, KVA, KW, and efficiency results;
      - 3) Mechanical Test:
        - a) Submit certification signed by a senior official of the pump manufacturer that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.
        - b) Submit test results to ENGINEER for review prior to delivery of the pumps to the Site.
  - 2. In the event of failure of any pump to meet any of the requirements, make necessary modifications, repairs, or replacements in order to conform to the requirements of this Section and re-test the pump until found satisfactory.

## **2.3 VERTICAL TURBINE PUMP**

- A. The pumps shall be of the vertical turbine type suitable for pumping chlorinated culinary water. All material, manufacturing, and performance standards shall be in compliance with AWWA E 103, NSF 60, NSF 61 and NSF 372, as applicable.

## B. Performance Requirements

### 1. Operating Conditions:

DESCRIPTION	Pump ID Number(s) (P-1, P-2, P-3)	Future Contract Pump ID Number(s) (P-4, P-5)
Duty	Continuous	Continuous
Drive	Variable Speed	Variable Speed
Ambient Environment	Indoors	Indoors
Ambient Temperature (°F)	40 to 100	40 to 100
Ambient relative humidity (%)	20 to 80	20 to 80
Fluid Temperature (°F)	35 to 60	35 to 60
Fluid pH range	6 to 9	6 to 9
Project site elevation (ft above msl)	4,615	4,615
NPSH Available (ft)	140	140
Pump Lubrication	Product	Product
Maximum shutoff head (ft)	330	380
Design flow capacity (gpm)	1,300	3,500
Design flow total dynamic head (ft)	230	230
Pump Setting Depth (ft) (Bottom of Discharge Head to Suction Bell)	13'-11"	13'-11"
Nominal Operating Speed (rpm)	1,800	1,800

DESCRIPTION	Pump ID Number(s) (P-1, P-2, P-3)	Future Contract Pump ID Number(s) (P-4, P-5)
Design flow min. efficiency (%)	83	84
Maximum Bowl Diameter (inches)	12	16
Column Size (diameter in inches)	12	16
Minimum Lineshaft Size (inches)	1.69	2.19
Minimum Barrel I.D. (inches)	29.25	29.25
Pump Model Number / Stages – (see alternate pump manufactures	National K12HC/4	National H16MC/3

DESCRIPTION	Pump ID Number(s) (P-1, P-2, P-3)	Future Contract Pump ID Number(s) (P-4, P-5)
Maximum Number of Pump Bowls for Design Barrel Length	4	3
Minimum Motor Horsepower (hp)	100	250
Utility Power (Phase, Volts, Hertz)	3, 480, 60	3, 480, 60
Motor Duty	Inverter Duty Rated	Inverter Duty Rated

2. Pump Characteristics - The pump shall be characterized by head capacity curves of steadily decreasing head with increasing capacity. Maximum head shall be at zero flow. The pump shall have a minimum efficiency as provided in the table above during operation against the system head. Pump head-capacity curves shall indicate that these losses have been included. Pumps shall have head-capacity curves similar to that of the specified pump. Pumps having curves that show a flatter or near horizontal slope over a section in the head–capacity curve will not be accepted. Curves with head-capacity curves with slopes of the curve flatter than that shown for the specified pump will not be accepted.
3. The pump and motor shall be capable of producing the flow rates and total dynamic heads indicated in the table above.
4. Motor Characteristics - Under no operating conditions shall the required pump brake horsepower exceed the nameplate rating of the motor being furnished.
5. The pump shall be designed to operate throughout its entire range without excessive vibration or noise.

#### C. Vertical Turbine Pump Components

1. Pumps
  - a. The vertical turbine pump shall be as manufactured by **National Pump Company, Flowserve, Floway, American Marsh** or approved equal, and shall be a multi stage bowl assembly.
  - b. Unless otherwise stated herein, the pump shall in all respects conform to the AWWA E 101 and shall comply with all local and state sanitary and safety regulations.
2. Discharge Head
  - a. Provide a discharge head for P-1, P-2, P-3. Provide a blind flange at P-4 & P-5..
  - b. The discharge head shall be an “F” style discharge head of fabricated steel (ASTM A53 Grade B Pipe and ASTM A 36 Steel Plate), accurately machined and with suction and discharge pipes in line with each other and located 180 degrees apart. Suction and discharge shall be provided with flanged connections for a working pressure of 175 psi and shall be sized to match the specified system. The top of the discharge head shall have a rabbet fit to accurately locate the vertical hollow shaft driver, and have a diameter equal to the driver base diameter (BD). Lifting lugs of sufficient strength to support the weight of the complete unit shall be provided. The base shall be round or square and be

machined to match the pump barrel and be capable of withstanding the system inlet pressure without leaking. CONTRACTOR shall modify the pump base dimensions on the Contract Drawings to match supplied head.

- c. A lifting soleplate shall be supplied and installed, if required by the pump manufacturer.
  - d. The pump manufacturer shall include the method of adjusting the pump impellers at the top of the head shaft. This method shall provide a positive locking device.
  - e. CONTRACTOR shall be responsible for ensuring that the discharge head is structurally and mechanically adequate for the provided and installed pump configuration.
3. Suction Barrel
- a. The pump suction barrels required in the new booster station (P-1, P-2, P-3, P-4, P-5) shall be the same diameter and provided with a suction barrel of the same materials as the discharge head. The barrel shall be capable of containing the maximum suction pressure (design for 150 psi min) applied to the suction connection. The bottom of the suction barrel shall be supplied with a welded cap for water service. CONTRACTOR may provide a bottom steel plate welded to the bottom of the suction barrel with bolt holes to plumb and level the barrel. Provide anti-vortex vanes on sides and bottom as indicated on the Contract Drawings.
  - b. The barrel shall be equipped with a square base plate which shall be machined and tapped to match the discharge head base flange. The base shall be drilled to allow the barrel to be secured in place with anchor bolts. Barrel shall be supplied with proper gasket or "O" ring and bolting for application to seal between the barrel flange and the head base flange. The square base flange shall accommodate an insulating flange which shall be field tested to function as intended.
4. Packing Boxes
- a. The pump shall have a split type mechanical seal with housing which bolts to the head with an "O" ring seal. The mechanical seal shall be able to be replaced without removing the motor. Mechanical seals shall be **442 High Performance Split Seal by Chesterton**, or approved equal. The housing shall have a lower bronze throttle bushing. The housing seal chamber shall accommodate a single sleeved balanced mechanical seal suitable for the maximum pressure developed by the pump and temperature of 100 degree F maximum. Seal materials shall be suitable for potable water and ANSI/NSF 61 certified. A balanced seal shall be mounted on a shaft sleeve. The shaft supplied shall be a one-piece bowl, line, and head shaft where practical of 416 stainless steel material.
5. Column Assembly
- a. The column assembly shall be supplied with ASTM A 53 Grade B steel pipe flanged or threaded with bronze bearing retainer equipped with suitable lineshaft bearings for the application. Column bearing spacing shall be such that shaft first critical frequency shall be safely above or below the operating resonant frequency.

6. Pump Bowl Assembly

- a. Pump bowl castings shall be of close-grained cast iron ASTM A48 Class 30 or ASTM A536 ductile iron Class 60-40-18 where required to meet the hydrostatic pressure criteria listed above. The water passages shall be free of blowholes, sand holes, and other detrimental defects, shall be lined with porcelain enamel, and shall be accurately machined and fitted. Provide bowl wear rings of hardened 17-4 stainless steel with a Rockwell C-Scale Hardness number of 44. The finished bowls shall be capable of withstanding a hydrostatic pressure equal to twice the head at rated capacity or 1-1/2 times the shut-off head, whichever is greater.
- b. The impellers shall be bronze ASTM B584 alloy C83800, enclosed type, and shall be statically balanced, and shall be fastened securely to the impeller shaft with taper split bushings of steel. Impellers shall be adjustable vertically by an external means. Impeller skirt and series case throat area shall be thick enough to allow for machining and wearing at the time of repair.

7. Pump Shaft

- a. The pump shaft shall be of A582 Grade 416 Stainless Steel turned, ground and polished. It shall be supported by bronze bearings of ASTM B505 alloy C84400 above and below each impeller. The suction case bearing shall be grease lubricated and protected by a bronze sand collar of ASTM B584 alloy C83800. The size of the shaft shall be no less than that determined by AWWA E101, Section A4.3 Paragraph 4.3.3.

D. FEA Analysis

1. In order to ensure that neither harmful nor damaging vibrations occur to the pump structure at any speed within the specified operating range, the following analysis shall be required:
  - a. Pump manufacturer shall perform a structural frequency analysis of the above ground structural components utilizing a FEA method to ensure that no structural natural frequencies are excited to a degree that would cause measured vibration amplitudes at the top of the discharge head to exceed the requirements of ANSI/HI 9.6.4-2009. When deemed necessary by the experience of the manufacturer, the below ground structural components shall also be included in the analysis.
  - b. The FEA method should include the use of ProE/Mechanica or an equivalent software. All pump assembly components, including the motor, shall be represented as solid elements, and if idealizations are used in place of solid elements, then a complete description of method for the idealization shall be included in the report. The analysis shall also include all modes of interest and pictorially represent each mode shape. Modes of interest are defined as those structural frequencies that exist below 120% of the maximum operating speed. When significant modifications are required to lower the system's natural frequency, the pump structure's stresses and deflections shall also be reviewed. Analysis reports shall conclude acceptable operation at the analyzed operating speeds. The design critical frequency shall be at least 20% above or below the operating range of the pump.
2. Manufacturer to provide documentation of the analysis ensuring that the specified requirements have been met, and that documentation should be signed and stamped by the professionally licensed engineer who performed the analysis work.



3. When measured in the direction of maximum amplitude on the pump and motor bearing housings, shall not exceed limits given in the latest ANSI/HI nomograph for the applicable pump type.

## **2.4 MOTOR**

- A. Pump motors shall be a vertical solid shaft, premium efficiency, inverter duty electric motor, and shall be sized as noted in the table above. They shall have a non-reverse ratchet, P-base, squirrel cage induction design. Motor shall have Class B or Class F insulation with temperature rise as specified by NEMA standards for class of insulation used and shall have a 1.15 service factor.
- B. Pump motors shall be provided with a vibration switch. Switch rating 120 VAC, 2 amps minimum.
- C. Pump motors shall be provided with a built-in 500 watt, 120 VAC condensate heater. Heater shall operate when motor is not running to reduce condensate.
- D. Pump motors shall have over temperature protection, which shall consist of a minimum of six RTD's embedded in the motor windings and two RTD's at the two bearings. Wiring to an external junction box shall be provided. RTD's shall be 100- ohm platinum three wire elements. This is required because future 250 hp (replacement) motors which will use same conduits as initial phase (will replace) 100 hp motors.
- E. Thrust bearing shall be chosen to handle the continuous down-thrust as specified by the pump manufacturer with an AFMBA B-10 bearing life of 12,320 hours, an L-10 bearing life of 17,500 hours, and an L-50 bearing life of 61,600 hours. Provisions shall be made for momentary up-thrust equal to 30% of rated down-thrust. The thrust value shall be calculated at curve points 75% to 125% of specified, full speed, flow rate.
- F. The motor shall be suitable for across-the-line starting, soft start, and shall be capable of reduced-voltage starting.
- G. The motor primary thrust bearing shall incorporate a shield or isolator to prevent damage from VFD harmonics and/or stray electrical currents.
- H. The motor rating shall be such that at design it will not be loaded beyond nameplate rating and at no place on the pump curve shall the loading exceed the service factor.
- I. The motor temperature shall be rated no higher than the allowable operating temperature of the motor thrust and radial bearings and in no case shall it exceed the temperature rating of the insulation class used to wind the motor.
- J. The junction box shall be oversized to accommodate the wiring connection.
- K. Motor shall be supplied with Polaris style lugs.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install pump and motor as shown on plans and per manufacturer recommendations.

- B. All pumps, complete with drive system, in place at the jobsite, shall not exceed acceptable field vibration limits given in the latest revisions of the Hydraulic Institute Standards. All pumps shall be free of static unbalance; shall be free of dynamic unbalance up to the maximum speed of the pump and drive system; shall be free of torsional vibration from 10 percent below the minimum speed to 10 percent above the maximum speed of the pump and drive system; and shall be free of apparent unbalance caused by defective bearings, by close fittings parts which may rub on the rotating parts intermittently, or by loose discs or rotor parts, or unbalanced loads.
- C. The motor/discharge head assembly shall be shimmed with respect to the suction barrel flange to bring the motor/discharge assembly into optimum alignment with any variations that the pump column and line shaft may exhibit from being truly plumb. Such shims must be structurally sound and securely attached. The water tight seal between the discharge head and the suction barrel flange must be maintained
- D. Contractor shall use Polaris terminations for field cable terminations.

### **3.2 FIELD TESTS**

- A. After installation, the pump shall be given an operating test to demonstrate freedom from mechanical defects, excessive noise, and vibration. The test shall include operating the pump continuously while throttling the discharge as needed. The operating test shall be performed for a minimum of one hour, or as directed by ENGINEER. Pumps with variable speed drives shall be tested at maximum speed, and at average and minimum speeds listed under specification for pumps. Actual test copies shall be furnished to ENGINEER.
- B. Tests for acceptable vibration shall be made, at no additional cost to OWNER, in the field on each pump system, which in the opinion of ENGINEER, seem to have excessive vibration. All field tests shall be running tests with the pump pumping the product for which it is intended and each pump system shall be tested separately with no other pumps running. All testing shall be done in the presence of ENGINEER. Amplitude as used in this Specification shall mean total peak-to-peak displacement. The required test for acceptable vibration will be the measurement of this peak-to-peak displacement and will be performed with an **IRD Vibration Meter, Model 306; Bently-Nevada TK-8;** or approved equal.

### **3.3 PROTECTIVE COATING**

- A. Coating and lining materials and equipment in accordance with the requirements of Section 09 90 00 Painting and Finishes.

### **3.4 DISINFECTING**

- A. Source of Water
  - 1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection of the pumping system.

### **3.5 TESTING PROCEDURE**

- 1. Leakage and pressure testing must be completed prior to disinfection procedures.

2. All pump and water piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the AWWA C651.
3. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfite ( $\text{NaHSO}_3$ ) shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm.
4. After approval of disinfection, CONTRACTOR shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.
5. At the end of the disinfecting period, a bacteriological test will be performed by OWNER to insure adequate disinfection and a second test will be taken at the end of an additional 24 hour period after the first test. If either of the tests fails to provide satisfactory bacteriological results, or shows the presence of coliform, then the line shall be re-chlorinated, flushed, and retested until satisfactory results are obtained at the expense to CONTRACTOR.

- END OF SECTION -

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**SECTION 33 13 00**  
**PIPELINE TESTING AND DISINFECTION**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section covers testing and disinfection in order to remove bacteriological contamination of the pipeline. Disinfection is only required if the pipeline is used for potable water.
- B. CONTRACTOR shall be responsible for obtaining permits for discharging excess testing water and dechlorination of such water, if required.

**1.2 RELATED SECTIONS**

- A. Related Work specified in other Sections includes but is not limited to the following:
  - 1. Section 01 33 00 Submittal procedures
  - 2. Section 33 05 05 Ductile Iron Fittings
  - 3. Section 33 05 07 Polyvinyl Chloride (PVC) Pipe (AWWA C900 and C905)
  - 4. Section 33 92 10 Steel Pipe, Specials, and Fittings (AWWA C200, Modified)

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
  - 1. AWWA C-651 - Disinfecting Water Mains
  - 2. Utah Public Drinking Water Regulations

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Furnish a written testing plan and schedule, including water source and methods for conveyance to the project, sequence, control, and disposal. Include the name of the certified bacteriological testing laboratory.
- C. Disinfection Report:
  - 1. Type and form of disinfectant used.
  - 2. Date and time of disinfectant injection start and time of completion.
  - 3. Test locations.
  - 4. Name of person collecting samples.
  - 5. Initial and 24 hour disinfectant residuals in treated water in parts per million (ppm) for each outlet tested.
  - 6. Date and time of flushing start and completion.
  - 7. Disinfectant residual after flushing in ppm for each outlet tested.

## **PART 2 MATERIALS**

### **2.1 DESCRIPTION**

- A. All test equipment, temporary valves, bulkheads, and other water control equipment, shall be as determined by CONTRACTOR. No materials shall be used which damage the project pipelines for future conveyance of potable water.
- B. Disinfecting materials shall consist of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.
- C. Dechlorination agents may be sodium bisulfate, sodium sulfite, or sodium thiosulfate.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Source of Water
  - 1. CONTRACTOR shall assume all responsibility to obtain the necessary water for testing and disinfection of the water line system. All testing water used in the pipeline shall be potable water from a State approved drinking water system.
  - 2. All pressure pipelines shall be tested.
  - 3. Disposal of flushing water and water containing chlorine shall be by methods acceptable to the State of Utah, Division of Water Quality.

### **3.2 HYDROSTATIC TESTING OF PIPELINES PROCEDURE**

- A. Prior to hydrostatic testing, pipelines 24-inches diameter and larger shall be swept free of debris and visually inspected that all debris has been removed prior to filling.
- B. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate. CONTRACTOR may test pipelines in sections. Sections to be tested shall be defined by isolation valves in the pipeline. Where such valves are not present, CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing. Sections that do not have isolation valves shall be tested in approximate one-mile segments. Sections that have a zero leakage allowance may be tested as a unit. No section of the pipeline shall be tested until field-placed concrete or mortar has attained an age of 14 Days. The test shall be made by closing valves when available or by placing bulkheads and filling the line slowly with water (maximum filling velocity shall not exceed 0.25 foot per second, calculation based on the full area of the pipe). CONTRACTOR shall be responsible for ascertaining that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure. CONTRACTOR shall provide sufficient temporary tappings in the pipelines to allow for trapped air to exit or for water to be drained. After completion of the tests, such taps shall be permanently plugged. Care shall be taken that air relief valves are open during filling.

- C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. The air within the pipeline shall be allowed to escape completely. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to ENGINEER shall be taken. Additional water shall be added to the pipeline to replace any water absorbed by the cement mortar lining.
- D. The hydrostatic test shall consist of holding 125% of the design operating pressure on the pipeline segment for a period of 2 hours. Visible leaks that appear during testing shall be repaired. Add water to restore the test pressure if the pressure decreases 5 psi below test pressure during the test period.
- E. Pipe with welded joints shall have no leakage. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.
- F. Exposed piping and valves shall show no visible leaks and no pressure loss during the test.
- G. Blowoff isolation gate valves and plug valves (throttling valves) shall be operated and tested during a simulated blow down operation to demonstrate functionality of the valves to the satisfaction of ENGINEER. Isolation valves (gate valves) shall not be used for throttling.

### **3.3 DISINFECTING OF PIPELINES PROCEDURE**

- A. Leakage and pressure testing must be completed prior to disinfection procedures.
- B. All water and solution piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C651).
- C. CONTRACTOR may use one of the three chlorination methods – tablet, continuous feed, and slug, as outlined in AWWA C651 that is acceptable to OWNER. Care must be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.
- D. CONTRACTOR shall provide sampling ports along the pipeline as defined in AWWA C651. Taps may be at manways and air valves to help facilitate the spacing requirement.
- E. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfate ( $\text{NaHSO}_4$ ), or other approved dechlorination agent, shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm total chlorine residual.

- F. After approval of disinfection, CONTRACTOR shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.
- G. After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the pipeline being tested. Sampling and testing will be completed by CONTRACTOR. CONTRACTOR shall collect at least one set of samples from every 1,200 feet of pipeline, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological (chemical and physical) quality in accordance with "Standard Methods for Examination of Water and Wastewater" and shall show the absence of coliform organisms. If the initial disinfection fails to provide satisfactory bacteriological results, or shows the presence of coliform, then the line shall be re-chlorinated, flushed, and retested until satisfactory results are obtained at the expense of CONTRACTOR.

### **3.4 CONNECTIONS TO EXISTING SYSTEM**

- A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before installation. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated.
- B. Final Fill: After a successful pressure and disinfection tests, the pipeline(s) shall be filled with fresh potable water and shall remain filled.

- END OF SECTION –



**SECTION 33 14 13**  
**DRAINAGE SYSTEM**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section covers the work to furnish excavate, install, backfill and complete the subdrainage system (ring drain), consisting of the drainage pipe, washed rock, geosynthetics, pipe and pipe fittings as necessary to complete installation of drainage pipe at the locations and grades shown on the drawings and as specified herein.
- B. This section also includes the supply and installation of the storm drain piping.

**1.2 RELATED WORK**

- A. Related work specified in other sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
  - 3. Section 31 05 19 Geosynthetics
  - 4. Section 31 23 15 Excavation, and Backfilling for Buried Pipelines
  - 5. Section 31 23 23 Excavation and Backfill for Structures

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text to by basic designation only.
- B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
  - 1. AASHTO M 294 Standard Specification for Corrugated Polyethylene Pipe, 12 to 60-in. Diameter.
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM C 150 Standard Specification for Portland Cement
  - 2. ASTM D 422 Standard Test for Particle-Size Analysis of Soils
  - 3. ASTM D 1248 Standard Specifications for Polyethylene Plastics Extrusion Materials for Wire and Cable
  - 4. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
  - 5. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
  - 6. ASTM D 2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
  - 7. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

8. ASTM D 3350 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
9. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
10. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing

**D. AMERICAN WATER WORKS ASSOCIATION (AWWA)**

1. AWWA C 901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2"-inch through 3-inch, for Water Service
2. AWWA C 906 Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution and Transmission
3. AWWA M 55 PE Pipe – Design and Installation.

**1.4 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for this section. Full compensation for the drainage system shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which the drainage system relates.

**1.5 SUBMITTALS**

- A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. CONTRACTOR shall provide the following Submittals:
  1. Submit catalog information on all pipe, fittings, couplings, gaskets, tapes, safety tapes, and tracer wires as shown on the Contract Drawings. Information shall indicate manufacture specification compliance and dimensional data.
  2. Submit cover and frame construction, features, configuration, and dimensions. Submit pipe connector materials and dimensions. Submit manhole step materials and dimensions. Submit manhole and structure joint sealant materials.
  3. Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.
  4. A plan for pipe joining and installation. The plan must be reviewed and approved by ENGINEER prior to pipe installation.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery and Storage: Materials delivered to the site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Plastic materials adversely impacted by ultraviolet light shall be protected from exposure to the direct sunlight over extended periods.
- B. Handling: Materials shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition. Pipe and other materials shall be carried to the trench, not dragged.

## **PART 2 PRODUCTS**

### **2.1 BACKFILL FOR STORM DRAIN**

- A. Backfill for the reinforced concrete pipe shall be in accordance with Section 31 23 15 - Excavation and Backfill for Pipelines.

### **2.2 PRECAST STORM DRAIN BOXES**

- A. Provide and install precast concrete storm drain boxes in accordance with City Standard Details shown in the Drawings.

### **2.3 PIPE FOR STORM DRAIN**

- A. Storm-Drainage Pipe shall be of the type and sizes indicated on the Contract Drawings and shall conform to the requirements specified. See Section 33 05 02, Reinforced Concrete Pipe.

### **2.4 TRACER WIRE**

- A. All direct bury piping (including service lines) shall be installed with 14 gauge solid copper THHN tracer wire for pipeline location purposes by means of an electronic line tracer.
  - 1. The wires must be installed along the entire length of the pipe on the top of the pipe and be held in place with ties or hitches spaced not more than 12-feet apart.
  - 2. Sections of wire shall be spliced together using approved splice caps and waterproof seals or solder. Twisting the wires together is not acceptable.

## **PART 3 EXECUTION**

### **3.1 EXCAVATION AND BACKFILL**

- A. Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by ENGINEER, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, and compacted as provided in these specifications. When removal of unstable material is due to the fault or neglect of CONTRACTOR in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to OWNER.

### **3.2 SAFETY**

- A. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29 CFR1926).

### **3.3 TRENCH PREPARATION**

- A. Each trench shall be excavated so that the pipe can be laid to the alignment and grade as required. The trench wall shall be so braced that the workmen may work safely and efficiently. All trenches shall be drained so the pipe laying may take place in dewatered conditions.

- B. The trench bottom shall be given a final trim using a string line, laser, or another method approved by ENGINEER for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe.

### **3.4 REMOVAL OF WATER**

- A. CONTRACTOR shall provide and maintain at all times ample means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation.
- B. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a menace to public health and convenience. No water shall be drained into work built or under construction without prior consent of ENGINEER.
- C. Dewatering shall be accomplished by well points, sumping, or any other acceptable method which will insure a dewatered trench. Any dewatering method shall be subject to the approval of ENGINEER.

### **3.5 BUTT FUSED HDPE PIPE JOINTS**

- A. Perform butt fusing of HDPE pipe joints per manufacturer instructions and obtain ENGINEER approval for butt joints.

- END OF SECTION -

**SECTION 33 92 10**  
**STEEL PIPE, SPECIALS, AND FITTINGS (AWWA C 200, modified)**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall provide fabrication and installation of buried steel pipe, specials, and fittings, complete and in place, in accordance with AWWA C200 and as modified herein. See Section 40 05 13.13 for steel process piping within pump station.
- B. A single pipe manufacturer shall be made responsible for furnishing steel pipe, specials, fittings, and appurtenances such as bolts and gaskets.
- C. A special is defined as any piece of pipe other than a normal full length of straight pipe. This includes, but is not limited to, elbows, manhole sections, short pieces of straight pipe, reducers, tees, and bulk heads.

**1.2 RELATED WORK**

- A. Related Work specified in other sections includes, but is not limited to:

- |                        |                                       |
|------------------------|---------------------------------------|
| 1. Section 01 33 00    | Submittal Procedures                  |
| 2. Section 01 50 30    | Protection of Existing Facilities     |
| 3. Section 09 90 00    | Painting and Finishes                 |
| 4. Section 09 98 10    | Pipeline Coatings and Linings         |
| 5. Section 31 23 15    | Excavation and Backfill for Pipelines |
| 6. Section 33 12 00    | Mechanical Appurtenances              |
| 7. Section 33 13 00    | Pipeline Testing and Disinfection     |
| 8. Section 40 05 13.13 | Steel Process Piping                  |

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
  - 1. ANSI B16.1 Cast-Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250
  - 2. ANSI B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
  - 3. ANSI/AWS B2.1 Specification for Welding Procedure and Performance Qualification
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 20 Standard Specification for General Requirements for Steel Plates for Pressure Vessels
  - 2. ASTM A 193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

3. ASTM A 194 Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
4. ASTM A 234 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
5. ASTM A 283 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
6. ASTM A 307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
7. ASTM A 370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products
8. ASTM A 563 Standard Specification for Carbon and Alloy Steel Nuts
9. ASTM A 572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
10. ASTM A 578 Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications
11. ASTM A 1011 Standard 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
12. ASTM A 1018 Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
13. ASTM E 165 Standard Practice for Liquid Penetrant Examination for General Industry

#### D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 200 Steel Water Pipe 6-inch and Larger
2. AWWA C 205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4-inch and Larger-Shop Applied
3. AWWA C 206 Field Welding of Steel Water Pipe
4. AWWA C 207 Steel Pipe Flanges for Waterworks Service - Sizes 4-inch Through 144-inch
5. AWWA C 208 Dimensions for Fabricated Steel Water Pipe Fittings
6. AWWA C 209 Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings
7. AWWA C 214 Tape Coating Systems for the Exterior of Steel Water Pipelines
8. AWWA C 216 Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings
9. AWWA C 219 Bolted, Sleeve-Type Couplings for Plain-End Pipe
10. AWWA C 606 Standard for Grooved and Shouldered Joints
11. AWWA C 651 Standard for Disinfecting Water Mains
12. AWWA M 11 Manual of Water Supply Practices – Steel Pipe – A Guide for Design and Installation

## 1.4 SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Shop Drawings

1. Prepare and submit certified dimensional drawings consistent with the pipeline alignment and grade on the Drawings, including all fittings and appurtenances, and with the size, location, elevation and slope information of existing utilities, pipelines, and encasements obtained by CONTRACTOR in accordance with Section 01 50 30 - Protection of Existing.
2. Joint and pipe/fitting wall construction details which indicate the type and thickness of cylinder; the position, type, size, and area of reinforcement; coating and lining holdbacks, manufacturing tolerances; and other pertinent information required for the manufacture of the product. Standard joint details shall be submitted where deep bell or butt strap joints are required for control of temperature stresses.
3. Details for elbows, wyes, tees, outlets, connections, test bulkheads, and nozzles or other specials that indicate amount and position of reinforcement. Fittings and specials shall be properly reinforced to withstand the internal pressure, both circumferential and longitudinal, and the external loading conditions as indicated in the drawings. Provide design calculations for all fittings and specials, including all reinforcement requirements.
4. Material lists and steel reinforcement schedules that describe materials to be utilized.
5. Line layout and marking diagrams which indicate the specific number of each pipe and fitting, the location of each pipe, and the direction of each fitting in the completed line compatible with requirements of AWWA Manual 11 (M-11). In addition, the line layouts shall include:
  - a. The pipe station and invert elevation at every change in grade or horizontal alignment.
  - b. The station and invert elevation to which the bell end of each pipe will be laid.
  - c. Elements of curves and bends, both in horizontal and vertical alignment.
  - d. Pipe joint type.
  - e. The limits within each reach of each type of field-welded joint and of concrete encasement.
  - f. Location of mitered pipe sections, beveled ends, butt straps and deep bell lap joints for temperature stress control.
  - g. Location and details for each valve, meter, pump, fitting, and other equipment as shown on the drawings used to determine pipe dimensions. Include location of closures, cut-off sections for length adjustment, temporary access manways, vents, and weld lead outlets for construction convenience.
  - h. Location of bulkheads, including those shown and as required, for hydrostatic testing of pipeline.
6. Welding Information
  - a. The Shop Drawings shall define the weld type and distinguish between shop and field welds. Shop Drawings shall indicate by welding symbols or sketches the details of the welded joints and the preparation of parent metal required to make them. Joints or groups of joints in which welding sequence or technique are especially important and shall be carefully controlled to minimize shrinkage stresses and distortion.
  - b. Written welding procedures for shop and field welds, including Welding Procedures Specifications (WPS's) and Procedure Qualification Records (PQR's) shall be submitted.
  - c. Written nondestructive testing procedure specifications and nondestructive testing personal qualifications for shop and field welds shall be submitted.
  - d. Current (within the last 6 months) Welder Performance Qualifications (WPQ's) shall be submitted for each welder used prior to their performing any Work either

in the shop or field. Qualification testing shall be as specified in paragraph 1.3 – Quality Assurance.

- e. Submit the credentials of CONTRACTOR's Certified Welding Inspectors (CWI's) and quality control specialist for review prior to starting any welding in the shop or field. The credentials shall include, but not be limited to, American Welding Society (AWS), QC-1 Certification. Other nondestructive testing (NDT) quality control personnel shall be certified as required by AWS D1.1.
  - f. Submit NDT data for each shop-welded and field-welded joint. This data shall include all testing on each weld joint, including re-examination of repaired welds, using radiographic testing (RT), magnetic particle testing (MT), dye penetrant testing (PT), ultrasonic testing (UT), or air test examination methods as specified. Test data shall be reviewed and signed by the CWI.
  - g. Submit a welder log for field and shop welding. Log shall list all welders to be used for the Work and the types of welds each welder is qualified to perform.
  - h. Submit a written weld repair procedure for each type of shop and field weld proposed for use on the project.
  - i. Submit a written rod control procedure for shop and field operations demonstrating how CONTRACTOR intends to maintain rods in good condition throughout the Work. The rod control procedure shall also demonstrate how the rods are used for each weld.
- 7. Drawings showing the location, design, and details of bulkheads for hydrostatic testing of the pipeline, and details for removal of test bulkheads and repair of the lining.
  - 8. Details and locations of closures for length adjustment and for construction convenience. Submit proposed sequencing of events to control temperature stresses in the pipe wall during installation prior to starting any field welding. Submit the proposed sequencing of events or special techniques to minimize distortion of the steel as may result from shop welding procedures. Submit plan for monitoring pipeline temperatures.
  - 9. Detail drawings indicating the type, number, and other pertinent details of the slings, strutting, and other methods proposed for pipe handling during manufacturing, transport, and installation.
  - 10. Manufacturer's written Quality Assurance/Control Program.
- C. Certifications: CONTRACTOR shall furnish a certified affidavit of compliance for pipe and other products or materials in AWWA C 200, AWWA C 205, AWWA C 206, AWWA C 207, AWWA C 208, AWWA C 209, AWWA C 214, AWWA C 216, AWWA C 219, and the following supplemental requirements:
- 1. Certified copies of mill test reports on each heat from which steel is rolled. Test shall include physical and chemical properties. Submit certified copies of mill test reports for flanges.
  - 2. Hydrostatic test reports.
  - 3. Results of production weld tests.
  - 4. Sand, cement, and mortar tests.
  - 5. Records of coating application, including technical data sheets, manufacturer name, product name and thickness.
- D. Performing and paying for sampling and testing necessary for certification are CONTRACTOR's responsibility.



- E. **Manufacturer's Qualifications:** Furnish a copy of manufacturer's certification to ISO 9000, SPFA, or LRQA, and documentation of manufacturer's experience in fabricating AWWA C200 pipe. Credentials shall include reference names, telephone numbers, and descriptions of projects for pipe conforming to AWWA C200 that is of similar diameter, length, and wall thickness to the pipe for this project.
- F. **Design Calculations of Fittings and Specials:** Furnish a copy of design calculations for fittings and specials including miters, welds, and reinforcement, prior to manufacture of pipe, fittings, and specials.

## **1.5 QUALITY ASSURANCE**

- A. **Pipe Manufacturer Qualifications:** The pipe manufacturer shall be certified to ISO 9000, the Steel Plate Fabricator's Association (SPFA), or Lloyd's Register Quality Assurance (LRQA) and shall be experienced in fabrication of AWWA C200 pipe of similar diameters, lengths, and wall thickness to this project. The manufacturer shall have the capability of meeting the schedule requirements of this project. Experience shall be in the production facilities and personnel, not the name of the company that owns the production facility or employs the personnel. Verification of experience and production capability will be conducted as part of the initial submittal review process for steel pipe and the CONTRACTOR's progress schedule.
- B. **Inspection:** Pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of AWWA C200, C205, C206, C208, and C214 as supplemented by the requirements herein. CONTRACTOR shall notify ENGINEER in writing of the manufacturing start date not less than 14 Days prior to the start of any phase of the pipe manufacture.
- C. **Tests:** Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of AWWA C200, C205, C206, C208, and C214 as applicable.
  - 1. After the joint configuration is completed and prior to lining with cement mortar, each length of pipe of each diameter and pressure class shall be shop-tested and certified to a pressure of at least 75 percent of the yield strength of the steel. The test pressure shall be held for 2 minutes and the pipe visually inspected to confirm that welds are sound and leak-free.
  - 2. In addition to the tests required in AWWA C200, weld tests shall be conducted on each 5,000-feet of production welds and at any other times there is a change in the grade of steel, welding procedure, or welding equipment. One set of tests per operator per work shift shall be performed.
  - 3. Fittings fabricated from straight pipe previously passing a hydrostatic test need not have an additional hydrostatic test provided welds are tested by nondestructive means and demonstrated to be sound.
  - 4. Material tests shall be performed at no additional cost to OWNER. ENGINEER and OWNER shall have the right to witness testing conducted by CONTRACTOR or pipe manufacturer/fabricator; provided that CONTRACTOR's schedule is not delayed for the convenience of ENGINEER or OWNER.
- D. **Welding Procedure Specifications:** Welding procedures used to fabricate and install pipe shall be in accordance with the ASME Boiler and Pressure Vessel Code (BPVC) for shop welds and ANSI/AWS D1.1 for field welds. Written welding procedures shall be

required for welds in the shop or the field. Welds qualified per the ASME BPVC shall include supplementary Essential Variables for notch-tough welding. Provisions of ANSI/AWS D1.1 qualified welds pertaining to notch-tough welding shall apply.

- E. Welder Performance Qualifications: Welding shall be performed by skilled welders, welding operators, and tackers who have had experience in the methods and materials to be used. Welders shall be qualified per the provisions of ASME BPVC for shop welds and ANSI/AWS D1.1 for field welds.

F. Shop Testing of Steel Plate Specials:

1. If any special has been fabricated from straight pipe not previously tested and is of the type listed below, the special shall be hydrostatically tested with a pressure equal to 1-1/2 times the design working pressure: This applies to bends, wyes, crosses, tees with side outlet diameter greater than 30 percent of the main pipe diameter, and manifolds.
2. Specials not required to be hydrostatically tested shall be tested by liquid dye penetrant inspection method in accordance with ASTM E 165, Method A or the magnetic particle method in ASME Section VIII, Division 1, Appendix VI.
3. Reinforcing plates shall be tested by the solution method using approximately 40 psi air pressure introduced between the plates through a threaded test hole. Test hole shall be properly plugged following successful testing.
4. Any weld defects, cracks, leaks, distortion, or signs of distress during testing shall require corrective measures. Weld defects shall be gouged out and re-welded. After corrections, the special shall be retested.
5. Where welded test heads or bulkheads are used, extra length shall be provided to each opening of the special. After removal of each test head, the special shall be trimmed back to the design points with finished plate edges ground smooth, straight, and prepared for the field joint.
6. Testing shall be performed before joints have been coated or lined.
7. Ultrasonic examination shall be performed in accordance with the following:
  - a. Steel plate that will be in welded joints or welded stiffener elements shall be examined ultrasonically for laminar discontinuities where both of the following conditions exist:
    - 1) Any plate in the welded joint has a thickness exceeding 1/2-inch.
    - 2) Any plate in the welded joint is subject to transverse tensile stress through its thickness during the welding or service.
  - b. Ultrasonic examination may be waived where joints are designated to minimize potential laminar tearing.
  - c. The ultrasonic examination shall be in accordance with ASTM A578 with a Level I acceptance standard.
8. Plates that are not in conformance with the acceptance criteria in ASTM A578 may be used in the WORK if the areas that contain the discontinuities are a distance at least 4 times the greatest dimension of the discontinuity away from the weld joint.

- G. Shop Nondestructive Testing: Nondestructive testing shall be performed for various weld categories as indicated below. Testing shall include submitting written documentation of procedures per Section V of the ASME Boiler and Pressure Vessel Code, and acceptance criteria shall be in accordance with Section VIII of the ASME BPVC.

1. Field Butt Joint Welds: Spot radiographically examine pipe in accordance with Paragraph UW-52 of the ASME BPVC Section VIII Division 1. If in the opinion of the ENGINEER, the welds cannot readily be radiographed, they shall be 100 percent ultrasonically examined.
  2. Fillet Welds: 100 percent examine every fillet weld using the magnetic particle inspection method.
  3. Groove Welds: 100 percent ultrasonically examine groove welds that cannot be readily radiographically spot examined.
  4. CONTRACTOR's certified welding inspector (CWI) shall 100 percent visually examine every weld as a minimum.
  5. In addition to weld tests indicated, doubler pads shall be air tested as stated in AWWA C206.
  6. CONTRACTOR shall be responsible for performing and paying for said tests and the ENGINEER has the right to witness testing conducted by CONTRACTOR.
- H. Onsite Observation: SUPPLIER shall provide an experienced staff member if requested by CONTRACTOR to be onsite while the pipe and fittings are being installed. The staff member's duties shall include, but not be limited to the following:
1. Observe the installation and welding of the pipe and fittings.
  2. Report any concerns to OWNER'S on-site observer.
  3. Answer questions and provide assistance to OWNER and CONTRACTOR.
- I. Certified Welding Inspector: Furnish the services of a certified welding inspector(s) (CWI) for the shop and field welding as specified in AWWA C200 and C206. After receiving CWI qualification, the CWI shall have at least 3 years of professional work experience similar to the work being performed for the project. The CWI's shall be directed by a CWI supervisor with at least 5 years of professional work experience similar to the work being performed for the project. The certified welding inspector(s) shall submit written certification that all welds were performed in conformance with these documents. Shop weld tests shall be reviewed and signed by the certified welding inspector(s).
- J. Field Testing: Field testing shall conform to the requirements of Section 33 13 00 - Pipeline Testing and Disinfection.
- K. Welding Requirements: Welding procedures used to fabricate and install pipe shall be prequalified under the provisions of ANSI/AWS D1.1 - Structural Welding Code-Steel or the ASME Boiler and Pressure Vessel Code, Section 9. Welding procedures shall be required for longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.
- L. Welder Qualifications: Welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9 by an independent local, approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the project shall be used in qualification tests.

## **1.6 WARRANTY**

- A. A one-year warranty for the pipe shall be included from CONTRACTOR and shall cover the cost of replacement pipe and freight to the project site, should the pipe have any defects in material or workmanship.
- B. In addition to the standard pipe warranty, the welding contractor shall provide in writing a warranty for a period of one year for all welded joints, including formation, installation, and pressure testing.
- C. Unless otherwise noted, the warranty periods shall begin when Substantial Completion is issued for the contract.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Manufacturers of steel pipe and steel fittings or specials shall be under the direction and management of one steel pipe manufacturer only. This does not prevent a separate fabricator from fabricating specials or fittings; however, WORK shall be directed by the Main Pipe Manufacturer. The responsibility of the Main Pipe Manufacturer shall include at a minimum:
  - 1. Verify pipe, fittings, and specials are being manufactured in full accordance with the drawings and specifications and applicable codes and standards.
  - 2. Manage the design, fabrication, testing and delivery of the pipe, fittings, and specials. Provide field support if requested to CONTRACTOR during installation and testing.
  - 3. Prepare and submit submittal information and Shop Drawings.
  - 4. Make any corrections that may be required to the submittal information and Shop Drawings.
  - 5. Certify that the pipe and specials have been manufactured in accordance with the Drawings and Specifications.
- B. Lined and coated steel pipe and specials shall conform to AWWA C 200, C 205, C 209, C 214, and C 216 subject to the following supplemental requirements. The pipe, specials, and fittings shall be of the diameter and class indicated and shall be provided complete with welded joints as indicated on the Drawings. For pipe, specials, and fittings 14-inches diameter and larger, the nominal inside diameter after lining shall not be less than the diameter indicated on the Drawings, allowing for tolerances according to AWWA C 200 and C 205. Pipe, specials, and fittings smaller than 14-inches diameter may be furnished in standard outside diameters. When indicated as a minimum, wall thickness tolerance shall be as allowed by AWWA C200 or the ASTM nominal sheet or plate tolerance, whichever is less.
- C. Markings: The manufacturer shall legibly mark pipe, specials, and fittings in accordance with the laying schedule and marking diagram. Each pipe, special, and fitting shall be numbered in sequence and said number shall appear on the laying schedule and marking diagram in its proper location for installation. Each pipe, special, and fitting number shall be located on the inside and outside area of pipe, special, and fitting. Interior marking shall be in full conformance with NSF 61. Each pipe, fitting and special shall be marked at each end with top field centerline. The word "Top" shall be painted or

marked on the outside top spigot of each pipe section or fitting. Mark "Top Match Point" for compound bends per AWWA C 208.

- D. Handling and Storage: The pipe, specials, and fittings shall be handled by use of wide slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment that might injure the pipe coating/exterior will not be permitted. Stockpiled pipe, specials, and fittings shall be supported on padded skids, sand or earth berms free of rock exceeding 2-inches diameter, sand bags, or suitable means so that the pipe including coating and lining coating will not be damaged. Pipe, specials, and fittings shall not be rolled and shall be secured to prevent accidental rolling. The ends of pipes shall be securely bulkheaded or otherwise sealed during transportation and shall remain sealed until installation.
- E. CONTRACTOR shall replace or repair any pipe, specials, and fittings damaged at no additional cost to OWNER.
- F. Strutting: Adequate strutting shall be provided on specials, fittings, and straight pipe so as to avoid damage to the pipe, specials, and fittings during handling, storage, hauling, and installation. For mortar-lined steel pipe, specials, or fittings the following requirements shall apply:
  - 1. The strutting shall be placed as soon as practicable after the mortar lining has been applied and shall remain in place while the pipe, special, or fitting is loaded, transported, unloaded, installed, and backfilled at the Site.
  - 2. The strutting materials, size, and spacing shall be the responsibility of CONTRACTOR and shall be adequate to support the earth backfill plus any greater loads that may be imposed by the backfilling and compaction equipment.
  - 3. Strutting on shop lined pipe shall consist of wood stulls and wedges. Strutting shall be installed in a manner that will not harm the lining.
  - 4. Any pipe, special, or fitting damaged during handling, hauling, storage, or installation due to improper strutting shall be repaired or replaced at no additional cost to OWNER.
- G. Laying Lengths: Maximum pipe laying lengths shall be 48-feet with shorter lengths provided as required to accommodate CONTRACTOR's operation.
- H. Lining: The pipe, specials, and fittings shall have smooth, dense interior surfaces and shall be free from fractures, excessive interior surface crazing, and roughness.
- I. Closures and Correction Pieces: Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing indicated. The locations of the correction pieces and closure assemblies shall be shown on the pipe layout diagrams.
- J. Backfill with CLSM: Where required, backfill with Controlled Low Strength Material (CLSM) shall be the full depth of the pipe zone from 6 inches below to 6 inches above the pipe as a minimum.

## 2.2 MATERIALS

- A. Mortar: Materials for mortar shall conform to the requirements of AWWA C 205; provided, that cement for mortar coating shall be Type II modified or Type V and mortar lining shall be Type II modified or Type V. Cement in mortar lining and coating shall not originate from kilns that burn metal-rich hazardous waste fuel, nor shall a fly ash or pozzolan be used as a cement replacement. Admixtures shall contain no calcium chloride.
- B. Steel for Cylinder and Fittings: Pipe, specials, and fittings manufactured under AWWA C200 shall satisfy the following requirements:
1. Minimum yield strength of steel is 42,000 psi.
  2. Be manufactured by a continuous casting process.
  3. Be fully killed.
  4. Be fine grain practice.
  5. Maximum carbon content of 0.25 percent.
  6. Maximum sulfur content of 0.015 percent.
  7. Minimum elongation of 22 percent in a 2-inch gauge length.
  8. Be in accordance with one of the following, ASTM A1011, ASTM A283, ASTM A572, or ASTM A1018.
  9. Maximum carbon equivalent of 0.45, calculated as follows:

$$CE = C + \frac{(Mn+Si)}{6} + \frac{(Cr+Mo+V)}{5} + \frac{(Ni+Cu)}{15}$$

- C. Pipe shall be manufactured as fabricated pipe per AWWA C 200 as modified herein. ASTM pipe manufacturing standards referenced in AWWA C 200 shall not be used. Pipe sections shall be fabricated by either of the following methods:
1. Pipe sections may be fabricated by spirally welded short cylindrical coils of steel, joined circumferentially by complete penetration butt joint welds.
  2. Pipe sections may be rolled or pressed from no more than three (3) sheets the full length of the pipe and welded with no more than three (3) longitudinal seams.
- D. Steel equal to or greater than 1/2-inch thick used in fabricating pipe shall be tested for notch toughness using the Charpy V-Notch test in accordance with ASTM A370. Test each heat of steel by taking one specimen from any two coils per heat number. The steel shall withstand a minimum impact of 25 ft-lb at a temperature of 30 deg F.
1. Plate: Charpy tests shall be conducted on each plate as required in ASTM A 20.
  2. Coils: Charpy tests shall be conducted on the first 500 tons of steel by testing each coil as follows:
    - a. Tests shall include representative sampling of steel thicknesses required for the Work.
    - b. Each coil shall be tested by taking coupons from the outer, middle, and inner wrap of the coil. Middle coil coupons may be taken from the ends of full-length pipes that are closest to the middle of the coil.
    - c. Coils that do not meet the above Charpy acceptance criteria shall not be used in the production of the pipe.

- E. External Pipeline Coating: In accordance with Section 09 98 10 – Pipeline Coatings and Linings.

## 2.3 DESIGN OF PIPE

- A. General: The pipe shall be suitable to transmit potable water under the conditions indicated on the Contract Drawings. The steel pipe shall have field welded joints as indicated. The pipe shall be cement mortar lined as per Section 09 98 10. Field lining will only be allowed where specifically approved in advance by ENGINEER.
- B. The pipe shall be designed, manufactured, tested, inspected, and marked according to applicable requirements previously stated and, except as hereinafter modified, shall conform to AWWA C200.
- C. Pipe Dimensions: Pipe shall be of the diameter and minimum wall thickness indicated on the Drawings.
- D. Fitting Dimensions: Fittings shall be of the diameter and class to match the adjacent piping.
- E. Joint Design: Provide shop fab fabricated joint types required on plans. No field welded joints allowed.
- F. Flanges
  - 1. Flanges shall be AWWA C 207 Class E.
  - 2. Shop lining and coating shall be continuous to the end of the pipe or back of the flange. Flanges shall be shop coated with a soluble rust preventive compound which is NSF 61 certified if used on potable water pipelines.
  - 3. Gaskets shall be full-face, 1/8-inch thick, cloth-inserted rubber, **Garlock 3505**, **Durlon 7910**, or approved equal.
- G. Bolts and Nuts for Flanges
  - 1. Exposed Flanges (Vaults and Pump Station): Bolts shall have ASME B1.1, Class 2A threads, and be manufactured of ASTM A193, Grade B7 and conform to ASME B18.2.1, and nuts shall have Class 2A fit, square or hex heavy dimensions in accordance with ASME B18.2.2, and be manufactured of ASTM A194, Grade 2H heavy hex. Bolts and nuts shall be Blue PTFE coated.
  - 2. Buried Flanges: Bolts shall have ASME B1.1, Class 2A threads, and be manufactured of ASTM A193, Grade B8M and conform to ASME B18.2.1, and nuts shall have Class 2A fit, square or hex heavy dimensions in accordance with ASME B18.2.2, and be manufactured of ASTM A194, Grade 8B heavy hex.

## 2.4 SPECIALS AND FITTINGS

- A. Design: Except as otherwise indicated, materials, fabrication and shop testing of Specials and fittings shall conform to the requirements stated above for pipe and shall conform to the dimensions of AWWA C 208. (Specials consisting of access manways, outlets for air valves, blow-off valves, etc. are excluded from the criteria as follows and collar plates, wrapper plates or crotch plates shall be required for reinforcing the outlet connections in accordance with AWWA M-11 and AWWA C208 requirements.) The

minimum thickness of plate for pipe from which specials are to be fabricated shall be the greatest of those determined by the following 3 criteria:

1. Working and Transient Pressure Design

$$T = \frac{P_w D / 2}{Y / S_w} \qquad T = \frac{P_t D / 2}{Y / S_t}$$

Where:

T	=	Steel cylinder thickness in inches
D	=	Outside diameter of steel cylinder in inches
P <sub>w</sub>	=	Design working pressure in psi
P <sub>t</sub>	=	Design transient pressure in psi
Y	=	Specified minimum yield point of steel in psi
S <sub>w</sub>	=	Safety factor of 2.5 at design working pressure
S <sub>t</sub>	=	Safety factor at design transient pressure; for elbows 1.875 and 2.0 for other specials

2. Mainline Pipe Thickness: Plate thickness for specials shall not be less than for the adjacent mainline pipe.
3. Thickness Based on Pipe Diameter

Nominal Pipe Diameter, in	Pipe Manifolds Piping Above Ground Piping Structures
24 and under	3/16-in
25 to 48	1/4-in
over 48	5/16-in

- a. Minimum plate thickness shall be the greater of the adjacent mainline pipe, the thickness on the Drawings, the thickness calculated as indicated herein or as shown on the table above indicating the minimum thickness based on pipe diameter.
  - b. Refer to ASME B36.10M for dimensions of wall thickness for standard weight pipe and nominal pipe size.
- B. Specials installed on saddle supports shall be designed to limit the longitudinal bending stress to a maximum of 10,000 psi. Design shall be in accordance with the provisions of Chapter 7 of AWWA Manual M 11.
- C. Reinforcement for wyes, tees, outlets, and nozzles shall be designed in accordance with AWWA Manual M 11. Reinforcement shall be designed for the design pressure indicated and shall be in accordance with the Drawings. Specials and fittings shall be equal in pressure design strength and shall have the same lining and coating as the adjoining pipe. Unless otherwise indicated, the minimum radius of elbows shall be 2.5 times the pipe diameter and the maximum miter angle on each section of the elbow shall not exceed 11-1/4 degrees.



- D. Moderate deflections and long radius curves may be made by means of beveled joint rings, by pulling standard joints, by using short lengths of pipe, or a combination of these methods; provided that pulled joints shall not be used in combination with bevels. The maximum total allowable angle for beveled joints shall be 5 degrees per pipe joint. Bevels shall be provided on the bell ends. Mitering of the spigot ends will not be permitted. The maximum allowable angle for pulled joints shall be in accordance with the manufacturer's recommendations or the angle which results from a 3/4-inch pull out from normal joint closure, whichever is less. Horizontal deflections or fabricated angles shall fall on the alignment. In congested city streets or at other locations where underground obstructions may be encountered, the chord produced by deflecting the pipe shall be no further than 6-inches from the alignment indicated.
- E. Vertical deflections shall fall on the alignment and be at locations adjacent to underground obstructions, points of minimum earth cover, and pipeline outlets and structures. The pipe angle points shall match the angle points indicated.
- F. Outlets, Tees, Wyes, and Crosses
1. Outlets 12-inches and smaller may be fabricated from Schedule 30 or heavier steel pipe in the standard outside diameters. Minimum plate thickness for reinforcements shall be 10-gauge.
  2. The design of outlet reinforcement shall be in accordance with the procedures given in Chapter 13 of AWWA Manual M 11 and the design pressures and factors of safety above.
  3. In lieu of saddle or wrapper reinforcement as provided by the design procedure in Manual M 11, pipe or specials with outlets may be fabricated entirely of steel plate having a thickness equal to the sum of the pipe wall plus the required reinforcement.
  4. Where Manual M 11 requires the design procedure for crotch plate reinforcement, such reinforcement shall be provided.
  5. Outlets shall be fabricated so that there is always at least a 12-inch distance between the outer edge of the reinforcing plate and any field welded joints. For outlets without reinforcing plates, outlets shall penetrate the steel cylinders so that there is at least a 12-inch clearance between the outlet and any field-welded joints.
  6. Tees, wyes, crosses, elbows, and manifolds shall be fabricated so that the outlet clearances and reinforcing plates from any weld joints are a minimum of 5 times cylinder thickness or 2-inches, whichever is greater. Longitudinal weld joints in adjacent cylinder sections shall be oriented so that there is a minimum offset of 5 times cylinder thickness or 2-inches, whichever is greater.
- G. Steel Welding Fittings: Steel welding fittings shall conform to ASTM A 234.
- H. Ends for Mechanical-Type Couplings: Except as otherwise indicated, where mechanical-type couplings are indicated, the ends of pipe shall be banded with Type C collared ends using double fillet welds. The collared ends shall be grooved for the fitting. Where pipe 12-inches and smaller is furnished in standard schedule thickness and where the wall thickness after grooving equals or exceeds the coupling manufacturer's minimum wall thickness, the pipe ends may be grooved.

## **2.5 CEMENT-MORTAR LINING**

- A. Cement-Mortar Lining for Shop Application: Unless indicated otherwise, interior surfaces of pipe, specials, and fittings shall be cleaned and lined in the shop with cement

mortar lining applied centrifugally in conformity with AWWA C 205. Lining for all mitered fittings produced by cutting, rolling and re-welding such as elbows from 5 to 90 degrees up to 72-inches in diameter shall be centrifugally applied in the shop. Fabricated tees, manifolds or elbows greater than 72-inches or tees with crotch plates where heat treating or normalization is required may be lined in accordance with AWWA C205. During the lining operation and thereafter, the pipe, specials, and fittings shall be maintained in a round condition by suitable bracing or strutting. The lining machines shall be of a type that has been used successfully for similar work. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found defective at the Site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications at no additional cost to OWNER.

- B. The minimum lining thickness and tolerance shall be in accordance with Section 09 98 10 – Pipeline Coatings and Linings and AWWA C 205.
- C. The pipe shall be left bare as indicated where field joints occur. Ends of the linings shall be left square and uniform. Feathered or uneven edges will not be permitted.
- D. Defective linings shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feather edged joints. Temperature and shrinkage cracks in the mortar less than 1/16-inch wide need not be repaired. Pipe specials or fittings with cracks wider than 1/16-inch shall be removed and patched.
- E. The progress of the application of mortar lining shall be regulated in order that handwork, including the repair of defective areas, is cured in accordance with the provisions of AWWA C205. Cement mortar for patching shall be the same materials as the mortar for machine lining, except that a finer grading of sand and mortar richer in cement shall be used when field inspection indicates that such mix will improve the finished lining of the pipe.
- F. Specials and fittings that cannot be mechanically lined and coated shall be lined and coated by hand-application using the same materials as used for the pipe and in accordance with the applicable AWWA or ASTM standards and this Section. Coating and lining applied in this manner shall provide protection equal to that for the pipe. Fittings may be fabricated from pipe that has been mechanically lined and/or coated. Areas of lining and coating that have been damaged by such fabrication shall be repaired by hand-application.
- G. Cement-Mortar Lining for Field Application at joints: Unless otherwise indicated, all steel pipe joints shall be mortar lined. The materials and design of in-place cement mortar lining shall be in accordance with Section 09 98 10 – Pipeline Coatings and Linings and AWWA C 205, and the following supplementary requirements:
  - 1. Pozzolanic material shall not be used in the mortar mix.
  - 2. Admixtures shall contain no calcium chloride.
  - 3. The minimum lining thickness shall be as indicated for shop-applied cement mortar lining, and finished inside diameter after lining shall be as indicated.
  - 4. Temperature and shrinkage cracks in the mortar less than 1/16-inch wide need not be repaired. Pipe, specials, or fittings with mortar cracks wider than 1/16-inch shall be removed and repaired.

- H. Protection of Pipe Lining/Interior: All pipe, specials, and fittings with plant-applied cement-mortar linings, shall be supplied with a 12-mil polyethylene sheet or other suitable bulkhead on the ends of the pipe and on each opening to prevent drying out of the lining. Bulkheads shall be substantial enough to remain intact during shipping and storage until the pipe is installed.

## 2.6 EXTERIOR COATING OF PIPE

- A. Exterior Coating of Exposed Piping: The exterior surfaces of pipe, specials, and fittings that will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of primer compatible with the finish coating required by Section 09 90 00 – Painting and Finishes.
- B. Exterior Coating of Buried Piping: Pipe for buried service, including bumped heads, shall be coated per Section 09 98 10 – Pipeline Coatings and Linings.
- C. Flexible coatings shall conform to Section 09 98 10 - Pipeline Coatings and Linings. Flexible coating systems shall include a cement mortar protective overcoat (rock shield), in accordance with Sections 09 98 10 - Pipeline Coatings and Linings.

## 2.7 PIPELINE MARKING TAPE

- A. Metallic Tape: Tape shall be minimum 5.5-mils thick aluminum foil imprinted on one side, encased in high visibility inert polyethylene jacket. Tape shall be 12-inches wide. Imprinted lettering shall be one-inch tall, permanent black, and shall read: “CAUTION – WATER LINE BURIED BELOW” or similar. Joining clips shall be manufacturer’s standard tin or nickel coated. Refer to Contract Drawings for location of tape placement.
  - 1. Tape shall be manufactured by **Reef Industries (Terra “D”)**, **Allen (Detectatape)**, or equal

## 2.8 DISMANTLING JOINT

- A. Provide dismantling joint were shown on the Contract Drawings. CONTRACTOR will not be allowed to substitute any other type of dismantling joint unless approved by ENGINEER. The coupling shall be rated as indicated on the Contract Drawings.
- B. Dismantling joint flange spools shall be fabricated from ASTM A53 steel and end ring and body shall be fabricated from ASTM A536 ductile iron Grade 65-45-12 or greater.
- C. Flanged coupling adapters shall be restrained with harness bolts or tie rods. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.
- D. Gaskets shall be composed of a rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Coating shall be fusion bonded epoxy. Bolts and nuts and tie rods shall be Type 304 stainless steel.
- E. Dismantling joints shall be **Model 975 by Smith-Blair**, **Model 309 by JCM**, **Model DJ400 by Romac**, or approved equal.

## **2.9 TRACER WIRE**

- A. All buried steel piping shall be installed with 14 gauge solid copper HMWPE tracer wire for pipeline location purposes by means of an electronic line tracer. Tracer wire shall be rated for direct burial and shall be rated for 600 volts. Tracer wire shall be RoHS compliant. Insulation shall utilize virgin grade material and shall meet the APWA color code standard for identification of buried utilities.
  - 1. The wires must be installed along the entire length of the pipe on the top of the pipe and be held in place with poly tape at all pipe joints and at 5 foot intervals.
  - 2. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Splice caps shall have a minimum rating of 600 volts. Twisting the wires together is not acceptable.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Handling and Storage: Pipe, specials, and fittings shall be carefully handled and protected against damage to lining and coating/interior and exterior surfaces, and impact shocks and free fall. Pipe, specials, and fittings shall not be placed directly on rough ground but shall be supported in a manner that will protect the pipe against injury whenever stored at the Site or elsewhere. Pipe, specials, and fittings shall be handled and stored at the Site in accordance with the requirements stated in Part 2, above. No pipe shall be installed when the lining or coating/interior or exterior surfaces show cracks that may be harmful as determined by ENGINEER. Such damaged lining and coating/interior and exterior surfaces shall be repaired or a new undamaged pipe, special, or fitting shall be provided at no additional cost to OWNER.
- B. Pipe damaged prior to Substantial Completion shall be repaired or replaced at no additional cost to OWNER.
- C. Repair of Defects: Patching inserts, overlays, or pounding out defects shall not be permitted. Repair of notches or laminations on second ends shall not be permitted. Deformation of pipe ends through mechanical means or other methods to achieve pipe fit up of defective pipe shall not be permitted. Damaged ends shall be removed to a point of uniform, non-damaged cylinder end and properly prepared. Distorted or flattened lengths shall be rejected. Buckled sections shall be removed and replaced with a full pipe cylinder. CONTRACTOR shall submit a written repair plan and receive favorable review from OWNER prior to the start of any repair work.
- D. CONTRACTOR shall inspect each pipe, special, and fitting for damage. CONTRACTOR shall remove or smooth out any burrs, gouges, weld splatter, or other small defects prior to laying the pipe, special, or fitting.
- E. Before placement of pipe, specials, or fittings in the trench, each shall be thoroughly cleaned of any foreign substance that may have collected thereon and shall be kept clean thereafter. For this purpose, the openings of pipes, specials, and fittings in the trench shall be closed during any interruption to the project.
- F. Pipe, specials, and fittings backfilled with CLSM shall be laid directly on moist sandbags or other suitable supports in preparation for the CLSM pipe zone material. Sandbags

shall be placed to provide at least 6-inches of CLSM below the bottom of the pipe. Sandbags shall be spaced at a maximum interval of 8-feet and one set shall be placed within 3-feet on both sides of each joint. CONTRACTOR shall provide additional sandbags as needed to support the pipe on line and grade. Excavation outside the normal trench section shall be made at field joints as needed to permit adequate access to the joints for field connection operations and for application of coating on field joints.

- G. Installation Tolerances: Each section of pipe, special, or fitting shall be laid in the order and position on the laying diagram and in accordance with the following:
1. Each section of pipe, special, or fitting having a nominal diameter less than 48-inches shall be laid to line and grade, within plus or minus 2-inches horizontal deviation and plus or minus 1-inch vertical deviation.
  2. Each section of pipe, special, or fitting having nominal diameter 48-inches and larger shall be laid to line and grade, within plus or minus 5 percent of diameter horizontal deviation and plus or minus 2.5 percent of diameter vertical deviation.
  3. In addition to the horizontal and vertical tolerances above, lay the pipe so that no high or low points other than those on the laying diagram are introduced.
  4. After installation, pipe, specials, and fittings shall not show deflection greater than 1.5 percent for mortar-lined and mortar-coated pipe, specials, and fittings; 2.25 percent for mortar-lined and flexible-coated pipe, specials, and fittings; and 3.75 percent for flexible-lined and flexible-coated or bare pipe, specials, and fittings. The allowable deflection shall be based on the design inside diameter.
  5. CONTRACTOR shall not permit the pipeline to experience a differential settlement after welding of more than 1.5" over 300 feet.
- H. Where necessary to raise or lower the pipe, specials, or fittings due to unforeseen obstructions or other causes, CONTRACTOR may change the alignment and/or the grades in accordance with the requirements of the Specifications and Drawings. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in a joint exceed 75 percent of the maximum deflection recommended by the pipe manufacturer without prior approval from ENGINEER. No joint shall be misfit any amount that will be detrimental to the strength and water tightness of the finished joint. In all cases the joint opening, before finishing with the protective mortar inside the pipe, shall be the controlling factor.
- I. Except for short runs, pipes shall be laid uphill if on grades exceeding 10 percent. Pipe that is laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement. Bends shall be installed as indicated.
- J. Struts in pipe 42-inches diameter and larger shall be left in place until backfilling operations have been completed. Struts in pipe smaller than 42-inches may be removed immediately after laying. CONTRACTOR shall monitor pipe deflection by measuring pipe inside diameter before struts are removed and 24 hours after struts are removed. Pipe deflection shall not exceed 3 percent 24 hours after the struts are removed. After the backfill has been placed, the struts shall be removed and shall remain the property of CONTRACTOR. For pipe backfilled with CLSM, struts shall be left in place until the CLSM backfill has obtained a minimum 7 day cure.
- K. Cold Weather Protection: No pipe, special, or fitting shall be installed upon a foundation into which frost has penetrated or at any time that there is a danger of the formation of

ice or penetration of frost at the bottom of the excavation. No pipe, special, or fitting shall be laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.

- L. Pipe, Specials, and Fitting Protection: The openings of pipe, specials, and fittings with shop-applied mortar lining shall be protected with suitable bulkheads to maintain a moist atmosphere and to prevent unauthorized access by persons, animals, water, or any undesirable substance. The bulkheads shall be so designed to prevent drying out of the interior of the pipe, specials, and fittings. CONTRACTOR shall introduce water into the pipe to keep the mortar moist if moisture has been lost due to damaged bulkheads.
- M. Flotation: At all times, means shall be provided to prevent the pipe from floating. Take necessary precautions to prevent the pipe from floating due to water entering the trench or from backfilling with CLSM. CONTRACTOR shall assume full responsibility for any damage due to this cause and shall at its own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating. Maintain the inside of the pipe free from materials and in a clean and sanitary condition.
- N. Pipe Cleanup: As pipe laying progresses, CONTRACTOR shall keep the pipe interior free of debris. CONTRACTOR shall completely clean the interior of the pipe of sand, dirt, mortar splatter, and any other debris following completion of pipe laying, pointing of joints, and any necessary interior repairs prior to testing and disinfecting the completed pipeline. When pipe laying is not in progress and at the end of each day, CONTRACTOR shall cover the exposed ends of all pipes to prevent animals, dust, dirt and other debris from entering the pipe.

### **3.2 FIELD WELDED JOINTS (NOT USED)**

### **3.3 FIELD JOINT COATING AND LINING (NOT USED)**

### **3.4 INSTALLATION OF PIPE APPURTENANCES**

- A. Protection of Appurtenances: Where the joining pipe is tape-coated, buried appurtenances shall be coated with cold-applied tape in accordance with Section 09 98 10 – Pipeline Coatings and Linings.
- B. Installation of Valves: Valves shall be handled in a manner to prevent any injury or damage to the valve or any part of it. Joints shall be thoroughly cleaned and prepared prior to installation. CONTRACTOR shall adjust stem packing and operate each valve prior to installation to verify proper operation.
- C. Valves shall be installed so that the valve stems are plumb and in the location indicated.
- D. Buried valves and flanges shall be wax tape coated and protected in accordance with Section 09 98 10 - Pipeline Coatings and Linings.
- E. Installation of Flanged Joints: Before the joint is assembled, the flange faces shall be thoroughly cleaned of foreign material with a power wire brush. The gasket shall be centered and the connecting flanges drawn up watertight without unnecessarily stressing the flanges. Bolts shall be tightened in a progressive diametrically opposite sequence and torqued with a suitable calibrated torque wrench. Clamping torque shall be applied

to the nuts only. Full face reinforced rubber gaskets shall be applied to the inside face of blind flanges with adhesive.

- F. Insulated Joints: Insulated joints and appurtenant features shall be provided as required. CONTRACTOR shall exercise special care when installing these joints to prevent electrical conductivity across the joint. After the insulated joint is completed, an electrical resistance test shall be performed by CONTRACTOR. If the resistance test indicates a short circuit, CONTRACTOR shall remove the insulating units to inspect for damage, replace all damaged portions, and reassemble the insulating joint. The insulated joint shall then be retested to assure proper insulation.
- G. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe. Bolts shall be tightened approximately the same amount. Diametrically opposite bolts shall be tightened progressively and evenly. Final tightening shall be done with a suitable calibrated torque wrench set for the torque recommended by the coupling manufacturer. Clamping torque shall be applied to the nut only.

### **3.5 MARKING TAPE INSTALLATION**

- A. Continuously install plastic marking tape along the pipe at the depth and location indicated.

### **3.6 PRESSURE TESTING**

- A. Pressure testing and disposal of test water shall be in accordance with Section 33 13 00 – Pipeline Testing and Disinfection.

- END OF SECTION –

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**SECTION 40 05 13.13**  
**STEEL PROCESS PIPING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. CONTRACTOR shall furnish and install all steel process piping and appurtenances as shown and specified, and as required for a complete and workable piping system.
- B. This Section includes schedule 40 and 80 steel process pipe in accordance with ASTM A53 and ASTM A106 with welded, flanged, grooved, or threaded joints **intended for use within pump station**. Fabricated steel pipe **and fittings may be used in pump station but shall be noted and submitted** in accordance with AWWA C200 – Steel Water Pipe, 6-inch and Larger, is included in Section 33 92 10 – Steel Pipe, Specials, and Fittings (AWWA C200, modified).

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 31 23 15 Excavation and Backfill for Pipelines
  - 3. Section 33 92 10 Steel Pipe, Specials, and Fittings (AWWA C200, modified)
  - 4. Section 33 12 00 Mechanical Appurtenances
  - 5. Section 33 13 00 Pipeline Testing and Disinfection

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.
- B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
  - 1. ASME B 16.1 Gray Iron Flanges and Fittings, Classes 25, 125, and 250
  - 2. ASME B 16.3 Malleable Iron Threaded Fittings, Classes 150 and 300
  - 3. ASME B 16.4 Gray Iron Threaded Fittings, Classes 125 and 250
  - 4. ASME B 16.5 Pipe Flanges and Flanged Fittings
  - 5. ASME B 16.9 Factory-Made Wrought Butt Welded Fittings
  - 6. ASME B 16.11 Forged Fittings, Socket-Welding and Threaded
  - 7. ASME B 16.12 Cast Iron Threaded Drainage Fittings
  - 8. ASME B 31.1 Power Piping
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - 2. ASTM A 106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
- D. AMERICA WELDING SOCIETY (AWS)

1. AWS D1.1 Structural Welding Code

E. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 207 Steel Pipe Flanges for Waterworks Services
2. AWWA C 606 Grooved and Shouldered Joints
3. AWWA C 651 Standard for Disinfecting Water Mains

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.
- C. Submit shop drawings of pipe, fittings, supports and appurtenances showing compliance with this Section including necessary dimensions, details, pipe joints and material lists.
- D. Submit gasket material data including manufacturer's catalog indicating that the proposed product is suitable for each fluid of service application.
- E. Submit welders' qualifications in accordance with AWS D1.1.

**PART 2 PRODUCTS**

**2.1 STEEL PIPE**

- A. Fabricate steel pipe in accordance with the Plans and with ASTM A 53 or ASTM A 106, Grade B. When Drawings don't specify a pipe wall thickness, use Standard Weight pipe, but in no case shall pipe be under 0.2 inch wall thickness.
- B. Line and coat steel pipe per Section 09 90 00 Painting and Coating and with NSF 61 approved lining. Galvanized pipe shall galvanized inside and out.

**2.2 PIPE JOINTS**

- A. Black steel pipe joints shall be screwed ends with NPT threads, welded, or flanged. Screwed joints shall be up with Teflon tape. Welded joints may have butt-weld or socket weld fittings or flanges. Where indicated on the Contract Drawings, provide grooved ends for rigid or flexible mechanical couplings or plain ends for sleeve-type couplings.
- B. Galvanized steel pipe shall have screwed ends with NPT threads. Screwed joints shall be up with Teflon tape. Where indicated on the Contract Drawings, provide grooved ends for rigid or flexible mechanical couplings or plain ends for sleeve-type couplings.
- C. Flanged joints shall be in accordance with ASME B16.5 or AWWA C207 flanges for the pressure class required for the project conditions or as indicated on the Contract Drawings. CONTRACTOR is responsible for providing the appropriate flanges required to connect steel pipe to equipment and other appurtenances. CONTRACTOR shall replace flanges that do not match the mating equipment or appurtenance at no additional cost to OWNER. Gaskets shall be ANSI 150 lb. full face, 1/8-inch thick

Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service

- D. Bolts shall comply with ASTM A193, with ASME 18.2.1, and have ASME B1.1, Class 2A threads with nuts having Class 2A fit and hex heavy dimensions per ASME 18.2.2.
  - 1. Exposed Flanges: Bolts shall be A193, Grade B7 (high strength steel). Nuts shall be A194, Grade 2H. Both shall be PTFE coated.
  - 2. Buried Flanges: Bolts shall be A193, Grade B8M (316 SS). Nuts shall be Grade A194, Grade 8B (made from 304 SS bars).

## 2.3 FITTINGS

- A. Threaded fittings shall be in accordance with ASME B16.3 or ASME B16.4. Threaded fittings for gravity pipe systems shall be in accordance with ASME B 16.12.
- B. Welded fittings shall be in accordance with ASME B 16.11 or ASME B 16.9. **Welded fittings may be fabricated per AWWA C208 requirements; such fittings shall be noted and shall be submitted per requirements of Section 33 92 10 STEEL PIPE, SPECIALS, AND FITTINGS**
- C. Flanged fittings shall be in accordance with ASME B 16.1 or ASME B 16.5.
- D. Grooved fittings shall conform to AWWA C 606.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Above ground steel process piping shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipe shall afford maximum headroom and access to equipment, and where necessary, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.
- B. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00 – Mechanical Metal Supports. Where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature changes.
- C. Unless otherwise indicated, connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection. Low points shall be provided with a drain valve.

### 3.2 PIPE PREPARATION

- A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. Ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly

### **3.3 PIPE JOINTS**

- A. Pipe threads shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape.
- B. Welded joints shall conform to the requirements of this Section and the recommendations of ASME B 31.1. Welding shall be done by skilled and qualified welders. Welders shall be qualified under the provisions of AWS D1.1. Machines and electrodes similar to those used in the work shall be used in qualification tests.
- C. Grooved couplings shall be installed per the manufacturer's recommendations and shall conform to AWWA C 606.
- D. All joints shall be visually drip tight.

### **3.4 INSPECTION AND TESTING OF PIPELINE**

- A. Completed steel process piping systems shall be inspected for proper supports, anchorage, and damage to pipe, fittings, and coatings. Any damage shall be repaired by CONTRACTOR at no additional cost to OWNER.
- B. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.
- C. Source of Water. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.
- D. Testing Procedure
  - 1. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Drawings, for a period of not less than one hour, without exceeding the tolerances listed on the Drawings. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices
  - 2. Leakage shall be determined by loss of pressure, soap solution, or other positive and accurate method. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
  - 3. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.
  - 4. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

### **3.5 DISINFECTING**

- A. Disinfection shall be in accordance AWWA C 651 and the requirements of Section 33 13 00 – Pipeline Testing and Disinfection.

- END OF SECTION -

**SECTION 40 05 13.19**  
**STAINLESS STEEL PROCESS PIPING**

**PART 1 GENERAL**

**DESCRIPTION**

CONTRACTOR shall furnish and install all stainless steel process piping and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.1

**RELATED WORK**

A.

Related Work specified in other sections includes, but is not limited to:

1.2

Section 01 33 00 Submittal Procedures

A.

Section 33 12 00 Mechanical Appurtenances

1.

2.

**REFERENCES**

1.3

Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

A.

B.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

1.

2.

3.

4.

ASME B 16.5 Pipe Flanges and Flanged Fittings

ASME B 16.9 Factory-Made Wrought Butt Welded Fittings

ASME B 16.11 Forged Fittings, Socket-Welding and Threaded

ASME B 31.1 Power Piping

C.

1.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

2.

3.

4.

ASTM A 312 Standard Specification for Seamless, Welded, and Heavy Cold Worked Austenitic Stainless Steel Pipes

ASTM A 403 Standard Specification for Wrought Austenitic Stainless Steel Piping and Fittings

ASTM A 409 Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service

D.

1.

ASTM A 778 Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

E.

1.

2.

**AMERICAN WELDING SOCIETY (AWS)**

AWS D1.1 Structural Welding Code

**AMERICAN WATER WORKS ASSOCIATION (AWWA)**

AWWA C 606 Grooved and Shouldered Joints

AWWA C 651 Standard for Disinfecting Water Mains

## **SUBMITTALS**

Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

1.4

- A. Submit shop drawings of pipe, fittings, supports and appurtenances showing compliance with this Section including necessary dimensions, details, pipe joints and material lists.

- C. Submit gasket material data including manufacturer's catalog indicating that the proposed product is suitable for each fluid of service application.

- D. Submit welders' qualifications in accordance with AWS D1.1.

## **PART 2 PRODUCTS**

E.

### **STAINLESS STEEL PIPE**

- 2.1 Stainless steel process pipe shall be in accordance with ASTM A 312, Type 304 seamless, Schedule 40S or 80S as shown on the Drawings, with screwed fittings for sizes up to and including 3-inches and welded fittings for sizes 3-inches and larger. Flange fittings may be used for pipe diameters 2-inches and larger.

A.

### **PIPE JOINTS**

- A. Stainless steel pipe 3-inches and smaller shall have screwed ends with NPT threads. Screwed joints shall be up with Teflon tape. Stainless steel pipe 3-inches and larger shall have welded joints or flanges. Flanges shall have stainless steel nuts and bolts the same material type as the pipe. Where indicated on the Drawings, provide grooved ends for rigid or flexible mechanical couplings. Pipe grooving is only allowed for Schedule 40S or 80S pipe. For plain end stainless steel pipe use sleeve-type couplings where noted on the Contract Drawings.

B.

Flanged joints shall be in accordance with ASME B16.5 for the pressure class required for the project conditions or as indicated on the Drawings. CONTRACTOR is responsible for providing the appropriate flanges required to connect stainless steel process pipe to equipment and other appurtenances. CONTRACTOR shall replace flanges that do not match the mating equipment or appurtenance at no additional cost to OWNER. Gaskets shall be ANSI 150 lb. full face, 1/8-inch thick Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service.

2.3

A.

B.

### **FITTINGS**

Threaded fittings shall be forged stainless steel fittings in accordance with ASME B 16.11.

Socket welded fittings shall be forged stainless steel fittings in accordance with ASME B 16.11.

Butt-welded fittings shall be wrought stainless steel fittings in accordance with ASTM A 403 and ASME B 16.9.

Flanged fittings shall be in accordance with ASME B 16.5.

C. Grooved fittings shall be wrought stainless steel conforming to ASTM A 403 and ASME B 16.9 and to AWWA C 606. Gasket material shall be suitable for the intended service.

D. Fittings shall be in accordance with the pressure class shown on the Drawings or have the same pressure rating as the pipe.

E.

### **PART 3 EXECUTION**

F.

#### **INSTALLATION**

3.1 Stainless steel process piping shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipe shall afford maximum headroom and access to equipment, and where necessary, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

A.

B. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00 – Mechanical Metal Supports. Where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature changes.

C.

3.2

Unless otherwise indicated, connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection. Low points shall be provided with a drain valve.

A.

#### **PIPE PREPARATION**

3.3

Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. Ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly

A.

B.

#### **PIPE JOINTS**

Pipe threads shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape.

Welded joints shall conform to the requirements of this Section and the recommendations of ASME B 31.1. Welding shall be done by skilled and qualified welders. Welders shall be qualified under the provisions of AWS D1.1. Machines and electrodes similar to those used in the work shall be used in qualification tests. Field welds shall be kept to a minimum by using couplings or shop fabrication as much as possible. Weld residue, oxide, and heat stain shall be removed shall be removed by stainless steel wire brushes followed by cleaning with an agent, followed by complete removal of the agent. Cleaning agent shall be **BlueOne Pickling Paste 130 by Avesta**

**Finishing Chemicals, STAR Gel by Krystal Surface Solution**, or approved equal. Passivation must following the cleaning process using **FinishOne Passivator 630 by Avesta Finishing Chemicals, STAR Pass 1 by Krystal Surface Solution**, or approved equal. Following the manufacturer's instruction for the cleaning/pickling and passivation process.

Grooved couplings shall be installed per the manufacturer's recommendations and shall conform to AWWA C 606.

## **INSPECTION AND TESTING OF PIPELINE**

- C. Completed stainless steel process piping systems shall be inspected for proper supports, anchorage, and damage to pipe, fittings, and coatings. Any damage shall be repaired by CONTRACTOR at no additional cost to OWNER.

3.4

- A. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.
- B.

Source of Water

- C. 1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.

- D. Testing Procedure

- 1. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Drawings, for a period of not less than one hour, without exceeding the tolerances listed on the Drawings. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices
- 2.

- 3. Leakage shall be determined by loss of pressure, soap solution, or other positive and accurate method. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
- 4.

Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.

- 3.5 A. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

## **DISINFECTING**

Disinfection shall be in accordance AWWA C 651 and the requirements of Section 33 13 00 – Pipeline Testing and Disinfection.

- END OF SECTION -



**SECTION 40 91 23**  
**MISCELLANEOUS PROPERTIES MEASUREMENT DEVICES**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section covers the Work necessary to install a ready to use and tested process and analysis system. CONTRACTOR shall provide all components required for a complete and functional system.

**1.2 RELATED WORK**

- A. Related Work in other sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures

**1.3 REFERENCES**

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.
- B. AMERICAN WATER WORKS ASSOCIATION (AWWA)
  - 1. AWWA C 207      Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
  - 2. AWWA C 751      Magnetic Inductive Flowmeters
- C. NSF INTERNATIONAL (NSF)
  - 1. NSF/ANSI 61      Drinking Water System Components - Health Effects

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit catalog cuts on all process equipment including: switches, meters, sensors, or other items shown on Contract Drawings referencing each item by mark number. Information shall indicate manufacturer specification compliance and dimensional data.
- C. CONTRACTOR shall supply operation and maintenance manuals for all process equipment.

**1.5 WARRANTY**

- A. Manufacturer shall provide to OWNER written guarantee against defects in material or workmanship for a period of one (1) year.

## **1.6 DELIVERY AND STORAGE**

- A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants. Each system shall be factory calibrated and certified prior to delivery.

## **1.7 MEASUREMENT AND PAYMENT**

- A. There shall be no separate measurement and payment for any systems. Full compensation for the system shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which it relates.

## **1.8 QUALITY ASSURANCE**

- A. Equipment to be furnished under this section shall be the product of manufacturers regularly engaged in the design and manufacturing of this type of equipment. The manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving CONTRACTOR from responsibility for the proper installation and functionality of the work.

# **PART 2 PRODUCTS**

## **2.1 GENERAL**

- A. Each process measurement system shall typically consist of a sensor and analyzer/transmitter. Where shown on the Contract Drawings, the analyzer/transmitter may be utilized for multiple sensors. When an analyzer/transmitter is used for multiple sensors, it shall be capable of displaying simultaneously each process measurement.
- B. Each analyzer/transmitter shall be equipped with a means to transmit process measurement data to the plant SCADA system.
  - 1. For hardwired signals, unless indicated otherwise on Contract Drawings, provide the following:
    - a. 4-20 mA output signals for each process measurement (for up to 500 Ohm loads).
    - b. Two programmable SPDT relay outputs, rated at 5A up to 230 VAC, for each process measurement.
  - 2. Where shown on the Contract Drawings, provide the following digital communications to the plant SCADA system:
    - a. HART Protocol
    - b. PROFIBUS
    - c. MODBUS
- C. Each analyzer/transmitter shall be powered by 115VAC (+/- 10%) at 60 Hz unless shown on Contract Drawings as being powered by 24 VDC (+/- 15%). Each analyzer/transmitter shall retain its programmable settings in non-volatile memory. Battery powered instruments, analyzer, or transmitters will not be accepted.
- D. Each sensor and corresponding analyzer/transmitter shall be supplied as a complete and operable system. This includes all cabling, mounting hardware and fasteners.

When installed outdoors, the analyzer/transmitter shall be protected from the sun such that direct sunlight will not shine on the display.

- E. All analyzers/transmitters shall be waterproof and made from corrosion resistant materials.
- F. All sensors to be immersed in liquids shall be rated for permanent submersion and shall be corrosion resistant.

## **2.2 CHLORINE ANALYZER**

- A. Prove **Kuntze Krypton DIS disinfectant measurement system with Argon StaiFlow**, no equal. Provide system fully assembled, function and field tested where shown on plans. Prove a system that measures free chlorine, chlorine dioxide, ozone, hydrogen peroxide, and temperature. System includes instrument, software, sensors, assembly and cables. Provide functional monitoring readable by RTU modbus.
  - 1. Pertinent specifications include the following:
    - a. Inlet size: 1/2-inch
    - b. Drain size: 1/2-inch
    - c. Analysis method: Amperometric
    - d. Minimum Pressure 2.5 psi
    - e. Power requirements: 110 VAC, 60Hz

## **2.3 MAGNETIC FLOW METERS**

- A. Magnetic flow meters shall be the low the low frequency induction type which produces a DC pulsed signal directly proportional to and linear with the flow rate. Liners shall be polyurethane. Flow meters shall be rated at 250 psi. Standard output shall be an analog 4-20 mA signal with a local indication from a liquid crystal display (LCD) reading in gallons per minute flow. The meter shall also have a totalizer (with pulsed output), and non-full pipe detection. Meters shall have a minimum of three (3) pair of flow measuring probes that provide accurate flow measurement with "zero up / zero down" straight pipe diameters. CONTRACTOR shall field verify length of cable for connection. Provide functional Ethernet connection to read meter.
- B. Flanged connections shall be constructed of Type 304 or Type 316 stainless steel with pressure ratings to match the connecting pipe.
- C. Liner shall be polyurethane or PTFE and electrodes stainless steel suitable for potable water service. Liners and electrodes for service other than potable water shall be constructed of materials conforming to the manufacturer's recommendation for the intended service.
- D. Meter housing shall be rated for NEMA 6 for submersible operation.
- E. Meters shall include grounding rings.
- F. The transmitter shall have six digit LCD displays for flow rate, percent of span, and totalization; be capable of measuring flow in both directions; automatic range change; capability to convert DC pulse signal from the tube to a standardized 4 to 20 mA DC

signal into a minimum of 700 ohms; self-diagnostics and automatic data checking, and a scaleable frequency output, 0 to 100 Hz.

G. The flow measuring system shall conform to the following:

1. Time constant: 0.5 to 1000 seconds; galvanic or optic isolation
2. Accuracy: 0.50 percent of flow rate from 10 to 100 percent full scale velocities over 3 feet per second.
3. Repeatability: 0.25 percent of full scale
4. Power consumption: 30 watts or less
5. Power requirements: 120 VAC, plus or minus 10 percent, unless indicated otherwise on the Contract Drawings. Battery powered flow meters are not acceptable.

H. Magnetic flow meters shall be **Proline Promag W400 by Endress Hauser with Ethernet connection**, or approved equal.

## 2.4 HIGH PRESSURE SHUTOFF SWITCH

A. A high-pressure shutoff switch shall be installed on each pump discharge pipe as shown on the Contract Drawings, and shall be as specified in the Electrical Specifications. The switch setting shall be adjustable as specified on the Contract Drawings. The switch shall be rated for the pressure of the system where it is installed with a safety factor of 1.5. Provide **Dwyer Mercoid Series DA/DS Model D with Mercury switch and enclosure**.

## 2.5 LOW PRESSURE SHUTOFF SWITCH

A. A low-pressure shutoff switch shall be installed on each pump suction barrel flange as shown on the Contract Drawings and shall be as specified in the Electrical Specifications. The switch setting shall be adjustable as specified on the Contract Drawings. Provide **Dwyer Mercoid Series DA/DS Model D with Mercury switch and enclosure**.

## 2.6 PRESSURE TRANSMITTER

A. The pressure transmitter shall be an electronic pressure transducer tailored to the installation as shown on the Contract Drawings and suitable for the planned application. The system shall include a pressure transducer with integral diaphragm seal. Pressure transmitter shall be 24 VDC, provide a 4-20 mA DC output to RTU. It shall have a loop signal and LCD display reading pressure in "psi" (range: 0 to 200 psi ); and be NSF 61 certified. Pressure transmitters shall have MP11 nitrogen filled reference volume, threaded piping connection, 316 SS body, and M-12 cable connector. Pressure transmitter shall be **PMC STS ATM/T Transmitter for Pressure and Temperature**, or approved equal. Provide isolation valve with pressure transmitter if none is shown in Contract Drawings.

# PART 3 EXECUTION

## 3.1 INSTALLATION

A. All equipment shall be mounted and installed as per manufacturer recommendations. Coordinate final location with ENGINEER.

### **3.2 FLOW METER FIELD CALIBRATION AND QUALITY CONTROL**

- A. Each instrument shall be tested before commissioning and ENGINEER shall witness the interface capability in the PLC control system and associated registers.
  - 1. Each instrument shall provide direct programming capability through the PLC
  - 2. Each instrument shall provide direct control of totalizer reset functions through the PLC
  - 3. Each instrument shall be supported with a device profile permitting direct integration in the PLC
- B. ENGINEER shall witness all instrument verifications in the field.
- C. Manufacturers Field Services shall be provided for start-up and commissioning by a Factory field service representative or a manufacturer's authorized service provider (ASP).
  - 1. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
  - 2. Manufacturer representative shall notify ENGINEER in writing of any problems or discrepancies and proposed solutions.
  - 3. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability, and electronics health. A comparative report shall be generated for each meter tested.
  - 4. Manufacturer representative shall generate a configuration report for each meter
  - 5. Meters shall be field calibrated to verify proper operation within the expected flow ranges for the project.

### **3.3 TESTING**

- A. After installation of the equipment is complete, operating tests shall be carried out to assure that the equipment operates properly. All piping shall be tested hydrostatically and for leaks. If any deficiencies are revealed during any tests, such deficiencies shall be corrected, and the tests shall be reconducted.

- END OF SECTION –

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**SECTION 40 92 57**  
**ELECTRIC MOTOR ACTUATORS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. The CONTRACTOR shall furnish and install electric motor actuators and appurtenances for butterfly valves, complete and operable, in accordance with the Contract Documents.
- B. The valve manufacturer shall be made responsible for coordination of design (valve stem diameter, threading, key and keyway adaptation, and other dimensional information), assembly, testing, and installation of actuators on the valves; however, the CONTRACTOR shall be responsible to the OWNER for compliance of the valves and actuators with the Contract Documents.
- C. Where two or more valve actuators of the same type or size are required, the actuators shall be produced by the same manufacturer.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:
  - 1. Section 01 33 00 Submittal Procedures

**1.3 REFERENCES**

- A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. American Water Works Association (AWWA)
  - 1. AWWA C 542 Electric Motor Actuators for Valves and Slide Gates

**1.4 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Shop drawing information for actuators, floor stands, and extension stems shall be submitted together with the valve submittals as a complete package.
- C. Submit information on electric motor actuator including cut sheets, technical brochures, electrical diagrams, control schematics, and operation and installation manuals.
- D. Submit calculations showing dynamic seating and unseating torques versus output torque of the actuator.

**1.5 MEASUREMENT AND PAYMENT**

- A. Electric motor actuators shall not be measured or paid as a separate item but shall be included as part of the item to which it relates.

**PART 2 PRODUCTS**

## **2.1 GENERAL**

- A. All electric motor actuators shall conform to the requirements of AWWA C 542.
- B. Actuators shall contain motor, gearing, manual over-ride, limit switches, torque switches, selector switch, drive coupling, integral reversing motor controls, control voltage transformer, indicator lights, handwheel, lubricants, heating elements, wiring, terminals, position feedback transmitter, and mechanical dial position indicator.
- C. In order to maintain the integrity of the enclosure, setting of the torque levels, position limits and configuration of the indication contacts, etc. shall be carried out without removal of any actuator covers over an Infra-Red or wireless interface.
- D. The electric motor actuator shall mount directly to the butterfly valve.
- E. Position and limit switches, position transmitters, controls, indicating lights, devices, and selector switches shall be coordinated with the input/output requirements of the control system as indicated in the Drawings and specified herein.

## **2.2 ACTUATOR SIZING**

- A. The actuator shall be sized to guarantee valve closure at the specified maximum pressure and flow within specified time shown in Table 40 92 57 -1 below.
- B. One actuator size shall be available covering output speeds from 18 to 200 rpm for a given torque range to avoid over-sizing and unnecessary weight load on the valve stem, flange, and yoke. An increase of actuator size caused by higher actuator output speed is not acceptable to avoid weight over-sizing actuators. Actuators must be selected to provide sufficient torque required for safe valve operation. Actuator output torque must be available at 90% of nominal voltage.

## **2.3 ENVIRONMENT**

- A. Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from 25°F to 140°F, up to 100% relative humidity.

## **2.4 ENCLOSURE**

- A. Actuators shall be o-ring sealed, watertight, NEMA 4. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed for site cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed.
- B. The enclosure must allow for temporary site storage without the need for electrical supply connection. All external fasteners shall be plated stainless steel. The use of unplated stainless steel or steel fasteners is not permitted.

## **2.5 MOTOR**

- A. The motor shall be specifically designed for the valve actuator service. The motor will be of the induction type with Class F insulation and protected by means of thermal switches imbedded in the motor windings. Motor enclosure will be total enclosed, non-ventilated.



- B. Motors shall be capable of operating on 480 volt, 3 phase, 60 Hz power.
- C. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gearcase.
- D. Protection shall be provided for the motor as follows:
  - 1. Stall – the motor shall be de-energized within 8 seconds in the event of a stall when attempting to unseat a jammed valve
  - 2. Over Temperature – thermostat will cause tripping of the motor, auto-reset on cooling
  - 3. Single phasing – lost phase protection
  - 4. Direction – phase rotation correction

## **2.6 GEARING**

- A. The actuator gearing shall be totally enclosed in an oil-filled or grease lubricated gearcase suitable for operation at any angle. All drive gearing and components must be of metal construction and incorporate a lost-motion hammerblow feature. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design shall be such as to permit opening the gearcase for inspection or disassembly without releasing the stem thrust or taking the valve out of service. For 90 degree operating type of valves drive gearing shall be self-locking to prevent the valve back-driving the actuator.

## **2.7 HAND OPERATION**

- A. A handwheel shall be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to electrical operation automatically by starting the motor. The handwheel or selection lever shall not move on restoration of motor drive. Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.
- B. Clockwise operation of the handwheel shall give closing movement of the valve unless otherwise noted. For linear type valves the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 90 lbs through stroke and 180 lbs for seating/unseating of the valve.

## **2.8 DRIVE INTERFACE**

- A. The actuator shall be furnished with a drive bushing easily detachable for machining to suite the valve stem or gearbox input shaft. The drive bushing shall be positioned in a detachable base of the actuator. Thrust bearings shall be sealed for life and the base shall be capable of withstanding five times the rated thrust of the actuator.

## **2.9 LOCAL CONTROLS**

- A. The actuator shall incorporate local controls for Open, Close and Stop, and a Local/Stop/Remote mode selector switch lockable in any one of the following three

positions: Local control only, stop (no electric operation), remote control plus local stop only. It shall be possible to select maintained or non-maintained local control.

- B. The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.
- C. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

## **2.10 TORQUE AND LIMITS**

- A. Torque and turns limitation to be adjustable as follows:
  - 1. Position Setting Range – multi-turn: 2.5 to 8,000 turns, with resolution to 7.5 degrees of actuator output.
  - 2. Position Setting Range – direct drive part turn actuators:  $90^{\circ} \pm 10^{\circ}$ , with resolution to 0.1 degree of actuator output.
  - 3. Torque Setting: 40% to 100% rated torque
- B. Position Measurement: Absolute position measurement should be incorporated within the actuator. The technology must be capable of reliably measuring position even in the case of a single fault. The design must be simple with the minimum amount of moving parts.
- C. Measurement of torque shall be from direct measurement of force at the output of the actuator. Methods of determining torque-using data derived from the motor such as motor speed, current, flux, etc. are not acceptable.
- D. A means for automatic “torque switch bypass” to inhibit torque off during valve unseating and “latching” to prevent torque switch hammer under maintained or repeated control signals shall be provided.
- E. The electrical circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.

## **2.11 REMOTE VALVE POSITION AND STATUS INDICATION**

- A. Four contacts shall be provided which can be selected to indicate any position of the valve. Provision shall be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during handwheel operation when all external power to the actuator is isolated.
- B. The contacts shall be rated for 5mA to 5A, 120V AC, 30V DC.
- C. As an alternative to providing valve position indication any of the four above contacts shall be selectable to signal one of the following:
  - 1. Valve opening, closing or moving
  - 2. Thermostat tripped, lost phase
  - 3. Motor tripped on torque in mid travel, motor stalled
  - 4. Remote selected
  - 5. Actuator being operated by handwheel
  - 6. Actuator fault

- D. Provision shall be made in the design for an additional four contacts having the same functionality.
- E. A configurable monitor relay shall be provided as standard, which can be used to indicate either Availability of Fault. The relay should be spring return type with a Normally Open/ Normally Closed contact pre-wired to the terminal bung.
- F. The Monitor (Availability of Fault) relay, being energized from the control transformer will de-energize under any one or more of the following conditions:

Available Mode	Fault Mode
Loss of main or customer 24V DC power supply	Loss of main or customer 24V DC power supply
Actuator control selected to local or stop	Motor thermostat tripped
Motor thermostat tripped	Actuator internal fault
Actuator internal fault	

- G. Provision shall be made in the design for the addition of a contactless transmitter to give a 4-20mA analog signal corresponding to valve travel and/or torque for remote indication when required. The transmitter will auto range to the set limits.

## 2.12 LOCAL POSITION INDICATION

- A. The actuator display shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully close in 0.1% increments. Valve closed and open positions shall be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted. With main power connected, the display shall be backlit to enhance contrast at all ambient light levels and shall be legible from a distance of at least 10 feet.
- B. Red, green, and yellow LEDs corresponding to open, closed, and intermediate valve positions shall be included on the actuator display when power is switched on. The yellow LED should also be fully programmable for on/off, blinker, and fault indication. The digital display shall be maintained and updated during handwheel operation when main power to the actuator is isolated.
- C. The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display operation, alarm, configuration, and graphical data logger information. Provision shall be made to upload a different language without removal of any covers or using specialized tools not provided as standard with the actuator.
- D. Data logger graphical displays should as a minimum be able to display log and trend graphs on the local LCD for the following:
  1. Torque versus Position
  2. Number of starts per hour
  3. Dwell time
  4. Average temperature
- E. The main display shall be capable of indicating 4 different home-screens of the following configuration:

1. Position and status
  2. Position and torque (analog)
  3. Position and torque (digital)
  4. Position and demand (positioning)
- F. Provision shall be made for the addition of an optional environment cover to protect the display for high levels of UV radiation or abrasive materials.
- G. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

## **2.13 INTEGRAL STARTER AND TRANSFORMER**

- A. The reversing starter, control transformer and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation. The starter shall be suitable for 60 starts per hour and of rating appropriate to motor size. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It shall have the necessary tapping and be adequately rated to provide power for the following functions:
1. Energizing of the contactor coils
  2. 24V DC or 110V AC output for remote controls (maximum 5W/VA)
  3. Supply for all the internal electrical circuits

## **2.14 REMOTE CONTROL FACILITIES**

- A. The necessary control, wiring, and terminals shall be provided integral to the actuator enclosure. Open and close external interlocks shall be made available to inhibit local and remote valve opening/closing control. It shall be possible to configure the interlocks to be active in remote control only.
- B. Remote control signals fed from an internal 24V DC (or 110V AC) supply and/or from an external supply between 20V and 60 V DC or 40V and 120 V AC, to be suitable for any one or more of the following methods of control:
1. Open, Close, and Stop Control
  2. Open and Close maintained or "push to run" (inching) control
  3. Overriding Emergency Shut-down to close (or open) valve from a normally closed or open contact.
  4. Two-wire control, energize to close (or open), de-energize to open (or close)
- C. Additionally provision shall be made for a separate 'drive enable' input to prevent any unwanted electrical operation.
- D. It shall be possible to reverse valve travel without the necessity of stopping the actuator. The motor starter shall be protected from excessive current surges during rapid travel reversal. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 2 kV.
- E. Provision shall be made for operation by distributed control system utilizing the following network systems:

1. Profibus
2. Modbus
3. Foundation Fieldbus
4. HART

## **2.15 MONITORING FACILITIES**

A. Facilities shall be provided for monitoring actuator operation and availability as follows:

1. Actuator text display indication of the following status/alarms:
  - a. Closed limit, open limit, moving open, moving closed, stopped
  - b. Torque trip closing, torque trip opening, stalled
  - c. ESD active, interlock drive
  - d. Thermostat trip, phase lost, 24V supply lost, local control failure
  - e. Configuration error, Position sensor failure, torque sensor failure
  - f. Battery low, power loss inhibit
2. Integral data logger to record and store the following operational data:
  - a. Opening last/average torque against position
  - b. Closing last/average torque against position
  - c. Total open/close operations
  - d. Maximum recorded opening and closing torque values
  - e. Event recorder logging operational conditions (valve, control, and actuator)

B. The data logger shall record relevant time and date information for stored data.

C. Data logger data shall be accessed via non-intrusive wireless communication and data displayed on the local LCD. Sufficient standard intrinsically safe tools shall be provided for downloading data logger and actuator configuration files from the actuators and subsequent uploading to a PC. The actuator manufacturer shall supply PC software to enable data logger files to be viewed and analyzed.

## **2.16 WIRING AND TERMINATION**

A. Internal wiring shall be tropical grade PVC insulated stranded cable of appropriate size for the control and 3-phase power. Each wire shall be clearly identified at each end. The terminals shall be embedded in a terminal block of high tracking resistance compound.

B. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal and shall be provided with a minimum of 3 threaded cable entries with provision for an additional 5 extra conduit entries.

C. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable. A durable terminal identification card showing a plan of terminals shall be provided attached to the inside of the terminal box cover indicating:

1. Serial number
2. External voltage values
3. Wiring diagram number
4. Terminal layout

- D. The code card shall be suitable for CONTRACTOR to inscribe cable core identification alongside terminal numbers.

## **2.17 COMMISSIONING KIT**

- A. Each actuator shall be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram, and cover seals to make good any site losses during commissioning period. In addition, sufficient actuator commissioning tools shall be supplied to enable actuator set-up and adjustment during valve/actuator testing and site installation commissioning.

## **2.18 PERFORMANCE AND TEST CERTIFICATE**

- A. Each actuator must be performance tested and individual test certificates shall be supplied with additional cost to OWNER. The test equipment should simulate a typical valve load, and the following parameters should be recorded:
1. Current at maximum torque setting
  2. Torque at maximum torque setting
  3. Flash test voltage
  4. Actuator output speed or operating time
- B. In addition, the test certificate should record details of specification such as gear ratios for both manual and automatic and second stage gearing if provided, drive closing direction, wiring diagram number.

<b>Table 40 92 57 – 1 Actuator Schedule</b>						
<b>Valve ID</b>	<b>Location</b>	<b>Service</b>	<b>Valve Type</b>	<b>Max Pressure/ Max Flowrate</b>	<b>Motor Type</b>	<b>Open/Close Speed (seconds)</b>
V-6	Pump Room	Throttling at Pump Startup	Butterfly	150 psi 3,500 gpm	Modulating	120/120
V-7	Pump Room	Throttling at Pump Startup	Butterfly	150 psi 3,500 gpm	Modulating	120/120
V-8	Pump Room	Throttling at Pump Startup	Butterfly	150 psi 3,500 gpm	Modulating	120/120
V-14	Pump Room	Continuous Modulating	Butterfly	25 psi head break 5,000 gpm	Modulating	120/120

## **2.19 MANUFACTURER, OR APPROVED EQUAL:**

- A. Limitorque
- B. AUMA Actuators SQ
- C. Rotork IQTM

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Electric motor valve actuators shall be installed in accordance with the manufacturer's written instructions. Actuators shall be located to be readily accessible for operation and maintenance without obstructing walkways.

### **3.2 SERVICES OF MANUFACTURER**

- A. Field Adjustments: Field representatives of valves with electric motor actuators shall adjust actuator controls and limit switches in the field for the required function.
- B. Inspection, Start-up, and Field Adjustment: The manufacturer shall furnish an authorized representative who shall visit the site and witness the following:
  - 1. Installation of the equipment – not less than 2 hours
  - 2. Inspection, checking, and adjusting the equipment – not less the 2 hours
  - 3. Start-up and field testing for proper installation – not less than 2 hours
- C. Instruction of OWNER's Personnel: The authorized representative shall visit the site for not less than 4 hours to instruct the OWNER's personnel in the operation and maintenance of the equipment including step by step troubleshooting procedures with necessary test equipment.

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**SECTION 43 42 22**  
**BLADDER STYLE SURGE TANK**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. The work described by this section of specifications consists of furnishing all equipment, materials, and labor to provide, install, and test two (2) vertical bladder-type surge tanks for potable water surge control as shown on the Contract Drawings and specified in the Contract Documents.

**1.2 RELATED WORK**

- A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes
3. Section 09 98 10 Pipeline Coatings and Linings
4. Section 33 92 10 Steel Pipe Specials and Fittings
5. Section 40 05 13.13 Steel Process Piping

**1.3 REFERENCES**

- A. The latest edition of the following publications forms a part of these Specifications to the extent referenced. The publications are referred to in the text to by basic designation only.

**B. CODES**

1. The building code referenced herein shall be the International Building Code (IBC) as defined in Section 01 42 19 entitled "Reference Standards".
2. ASME Boiler and Pressure Vessel Code.
3. American Welding Society (AWS) Fabrication Code.
4. ASME Fabrication Code
5. National Board Inspection Code (NBIC)
6. NEMA Industrial Control Systems Code

**C. COMMERCIAL STANDARDS**

1. ANSI B 16.3-85 Malleable iron threaded fittings Class 150 and 300
2. ANSI B 16.9-86 Factory-made wrought steel butt welding fittings
3. ASTM A 36 Rolled structural steel bars, plates, shapes, and sheet piling
4. ASTM A 53-87 Pipe, steel, black and hot-dipped, zinc-coated welded and seamless
5. ASTM A 47-84 Malleable iron castings
6. ASTM A 197-87 Cupola malleable iron
7. ASTM A 234-87 Pipe fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures
8. ASTM A 285 Pressure vessel plates, carbon steel, low- and intermediate-tensile strength intended for fusion-welded pressure vessels
9. NEMA ICS 6 Enclosure

- 10. SSPC-SP5      Shop blast surface preparation - White Metal Blasting Cleaning
- 11. SSPC-SP6      Shop blast surface preparation - Commercial Blast Cleaning
- 12. SSPC-SP10     Shop blast surface preparation - Near White Metal Blast Cleaning

#### **1.4 SUBMITTALS**

- A. The following shall be submitted in accordance with Section 01 33 00 - Submittal Procedures:
  - 1. Complete dimensional fabrication drawings of the surge tank and include the dimensions of all equipment, accessories, supports, connections, outlets, and all related piping, including accurately dimensioned connection piping.
  - 2. Catalog cut sheets for all accessories and piping.
  - 3. Tank NSF 61 certification.
  - 4. Equipment weights and anchor bolt designs.
  - 5. Stamped calculations prepared by a professional engineer (registered in the State of Utah) for approval before tank fabrication.
  - 6. Immediately following fabrication, and before tank shipment, provide a Certification of ASME Code stamp. This document shall be signed by the fabricator and shall bear a notary stamp for the state in which fabrication takes place and shall indicate that the code stamp has been obtained for the tank actually to be supplied.

#### **1.5 QUALITY ASSURANCE**

- A. This Specification has been constructed around vertical bladder-type vessel(s) as manufactured by Charlante of America. Any related construction and/or design modifications necessitated due to the use of an alternate tank design shall be the responsibility of CONTRACTOR.
- B. The manufacturer shall be iso-9001 certified which includes engineering, design, manufacturing and testing complete components. Vessel manufacturer shall manufacture their own vessels and bladders within the same plant as per quality control through ISO.
- C. Manufacturer shall provide inhouse x-rays of welds if required by ASME code, hydrostatic test, and ASME inspection. ENGINEER reserves the right to inspect the vessel manufacturing facility to confirm requirement above.

#### **1.6 MEASUREMENT AND PAYMENT**

- A. Full compensation for the Bladder Style Surge Tanks shall be considered as included in the contract lump sum bid price as shown on the Bid Schedule.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. The vertical bladder-type surge tanks shall be provided with the manufacturer's services at the jobsite at no additional cost to OWNER. One full 8-hour day of service from manufacturer's representative shall be provided per tank to approve the tank installation and advise CONTRACTOR during startup, testing, and final adjustment of each tank. In addition to this day, one additional full 8-hour day shall be provided in a separate trip to

instruct OWNER's personnel in the operation and maintenance of the tank system.

## 2.2 SURGE TANKS

- A. The tanks shall be a vertical, bladder-type vessel suitable for use with potable water. Tanks shall be manufactured by **Charlotte**, or approved equal. Tanks shall be cylindrical with elliptical (or similar) heads.

### SURGE TANKS SCHEDULE

ITEM	Zone 1 Tank	Zone 2 Tank
Volume (gallons/cubic feet)	925 gallons / 124 cu ft	3040 gallons / 406 cf
Diameter	5.00 feet	8.00 feet
Configuration	Vertical	Vertical
Approx. Height w/ Base	9.5 feet	11.5 feet (max height w/ base)
Design Pressure	80 psi (max surge pressure)	180 psi (max surge pressure)
Design Test Pressure	150 psig	250 psi
WSP Inlet Diameter	14.00 inches OD	14.00 inches OD

- B. Structural Design and Supports shall include the tank, supports, and anchor bolts shall be designed based upon local building codes in addition to the following criteria:

1. Design for a hydrostatic operating pressure of 250 psi and a test pressure of 375 psi with no reactive load permitted through the inlet/outlet piping. Floor under tanks is 10 min thick reinforced concrete per plans.
2. Support tank by support legs (four minimum) for attaching to a concrete floor slab. Material of construction shall comply with ASTM A 36 or ASTM A 285, Grade C. Weld the support legs to the tank.
3. Seismic Design Parameters to conform to the current IBC (if necessary and required by design engineer).

#### C. Surge Tank Design and Materials

1. Materials for the tank, design, and shop fabrication and inspection shall comply with Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code with only the plate steels in Table UCS-23 of said code being used. Provide ASME code stamp, National Board Registration number and pressure rating on tank.
2. Minimum design pressure shall be as stated in this section of the Specifications. Perform hydrostatic testing in shop. Test pressure shall be 150% of the design pressure of the tank.
3. The surge tank, the bladder, coating and lining shall be NSF 61 approved, and listed on the NSF database, for use with potable water applications. Proof of NSF listing of the entire tank model shall be submitted to ENGINEER.
4. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be provided by CONTRACTOR.

5. Bladders and replacement bladders shall be manufactured in the tank manufacturers' plant. Tanks/Vessels shall be fabricated by listed manufacturer, not contracted out.
6. Provide a 1/2-inch threaded connection at the top of the tank to contain a gas charging valve and pressure gauge. Tank shell will be constructed of deep drawn carbon steel double sub-arc welded domes and side shells with double welded seams. Tank shall be equipped with a food grade, heavy duty butyl rubber bladder. The precharge pressure will be located between the shell of the tank and the bladder. The top manhole shall be removable to allow inspection and maintenance of the bladder. The bladder shall be sized to conform to the inner shape of the vessel. Bladder tank shall be of the vertical configuration.
7. Bladder tank shall conform with NBIC.

#### D. Service Conditions

1. Tank hydraulic performance conditions and design data shall be as shown on Contract Drawings. In the event that the manufacturer's hydraulic analysis of the system yields varying design requirements, ENGINEER should be contacted.

#### E. Valves

1. The tank shall be designed to function properly with the specific valves, including but not limited to plug valves and check valves, submitted by CONTRACTOR. Acceptance of these valves shall be clearly stated in the surge tank submittal.
2. Safety (Pressure Relief) Valve: The valve shall have a stainless-steel body and bonnet and shall have stainless steel trim. Pressure relief valves shall be certified to ASME Section VIII, GENERAL REQUIREMENTS, UG-125, AND 126. Set at 450 psig. Valves shall be **Apollo Series 500**, or approved equal.

#### F. Level monitoring

1. Pressure differential transmitter shall be **Rosemount Model 3051 diginat pressure transmitter** or approved equal
  - a. Transmitter shall be two-wire, capacitance (DP/GP) or piezoresistive (AP/GP), high performance differential/gage/absolute/level/flow pressure transmitter with HART® based fieldbus based digital communication capabilities.
  - b. Pressure transmitter shall be NEC 501-5, NEMA code ICS6 and FM certified and have 4-20 mA output signal.
  - c. Pressure differential transmitter shall be hard mounted on the tank via a 2-inch 150 lbs flange
2. Magnetic Level Gauge (optional)
  - d. Tank shall be equipped with a magnetic level gauge

#### G. Painting and Coating

1. All coating and lining shall be completed at the factory per 09 90 00 – Painting and Finishes.

## **PART 3 EXECUTION**

### **3.1 TESTING**

#### **A. FABRICATION TEST**

1. The Surge Tank shall be shop tested hydrostatically to a pressure of 1.5 times the design pressure for a period of not less than 24 hours. All leaks shall be detected and immediately repaired prior to painting.

#### **B. FIELD STATIC TEST**

1. The Surge Tank and system piping shall be hydrostatically tested to the design pressure immediately following installation and before any dynamic testing. Test period shall be four hours minimum, and all leaks detected shall be immediately repaired. Finish touchup painting shall be provided as necessary.

#### **C. FUNCTIONAL TEST**

1. The surge tank manufacturer shall verify the performance of the surge protection equipment provided, by recording surge pressures following three (3) maximum flow (all 3 pumps running at capacity) pump trips and detail the pressure and flow results in a written document detailing each event. During the required field visit, at least one pump trip will be used by ENGINEER to provide field data needed for the surge model calibration. Field data will be provided to ENGINEER to develop and evaluate the surge computer model. The surge tank vendor shall provide all equipment needed to record the field data during a pump trip. The pressure shall be recorded with a pressure transducer capable of recording the surge pressures at a sample rate of 100 recordings per second. The manufacturer shall provide temporary transducers and software for use during testing.
2. CONTRACTOR shall provide to ENGINEER a complete report of each test performed within ten days after test completion. Reports shall include:
  - a. Date and time of all testing.
  - b. Description of method of testing including pumping combinations, pressure records, etc.
  - c. Description of all observed leaks and method and date of repair. Description of any catastrophic failures.
  - d. Certification that necessary repairs have been made.
  - e. Signature of CONTRACTOR and Manufacturer's representative.

### **3.2 TANK INSTALLATION**

- A. The tank shall be installed in accordance with the manufacturer's recommended procedures. All supports, piping, valves, and related appurtenances shall be provided and installed by CONTRACTOR at no additional cost to OWNER.
- B. Provide rigid grooved-end AGS coupling about 6-inches off floor to connect the grooved end of the surge tank inlet pipe (at base of tank) to the pump station pipe into floor.
- C. Use stainless steel metal shims and stainless-steel-mesh-reinforced-5,000 psi-grout pads under tank legs to firmly secure tank so there is zero movement when tank is

bumped to shoved, or in a seismic event, and during tank and piping pressurizing and surge testing. Grout pads shall extend 2 to 3 inches beyond tank supports. Before placing grout, trim off stainless steel mesh and shims so they are covered with at least 1" of grout.

- END OF SECTION -