



**CITY OF CARLSBAD, NEW MEXICO**

**CONTRACT DOCUMENTS FOR**

**BID 2015-13**

**WASTEWATER TREATMENT FACILITY**

**EFFLUENT REUSE TRANSFER PUMP STATION**

**MAY 2015**

**PREPARED BY**

**HDR ENGINEERING, INC.**

**2155 LOUISIANA BLVD. N.E.**

**SUITE 9500**

**ALBUQUERQUE, NEW MEXICO**



**HDR PROJECT NUMBER: 239605**



### **Engineer's Certification**

I, Wade Chacon, certify that I am a licensed Professional Engineer in the State of New Mexico (PE #17857) and that these contract documents were prepared by me or under my direction.





## TABLE OF CONTENTS

### VOLUME I – CONTRACT DOCUMENTS

ADVERTISEMENT FOR BIDS.....	C-111
INSTRUCTIONS TO BIDDERS.....	C-200
PRE-BID INQUIRY FORM.....	PBI-1
BID FORM .....	C-410
BIDDER'S QUALIFICATION STATEMENT .....	BQ-1
BID BOND .....	C-430
AGREEMENT.....	C-520
PERFORMANCE BOND .....	C-610
PAYMENT BOND .....	C-615
GENERAL CONDITIONS.....	C-700
SUPPLEMENTARY CONDITIONS .....	C-800
NOTICE OF AWARD .....	C-510
NOTICE TO PROCEED.....	C-550
WORK CHANGE DIRECTIVE .....	C-940
FIELD ORDER.....	C-942
CHANGE ORDER.....	C-941
APPLICATION FOR PAYMENT FORM .....	C-620
CERTIFICATE OF SUBSTANTIAL COMPLETION .....	C-625
STATE MINIMUM WAGE RATES .....	
TECHNICAL SPECIFICATIONS .....	

### VOLUME II – CONTRACT DRAWINGS



**City of Carlsbad, New Mexico  
Purchasing Department**

**Bid # 2015-13**

**Date of Bid Opening: May,29,2015**

**Time of Bid Opening 2:00 P.M. (MDT)**

**Wastewater Treatment Facility Effluent Reuse Transfer Pump Station**

ADVERTISEMENT FOR BIDS

Sealed Bids for the construction of the **City of Carlsbad, Effluent Reuse Transfer Pump Station Project** will be received by **The City of Carlsbad, NM**, at the office of the **Purchasing Department, 101 N. Halagueno, Carlsbad NM 88220**, until 2:00 p.m. local time on Friday, May 29, 2015, at which time the Bids received will be publicly opened and read. The Project consists of **constructing a new reuse transfer pump station and forcemain located at wastewater treatment facility**. Bids will be received for a single prime Contract. Bids shall be on a lump sum basis as indicated in the Bid Form.

Contract Documents (including Instructions to Bidders, bidding forms, special provisions, etc. to be used in connection with the submission of bids) and plans are available online on the City's website at [www.cityofcarlsbadnm.com/purchasing.cfm](http://www.cityofcarlsbadnm.com/purchasing.cfm). For questions, please contact the Engineer:

HDR Engineering, Inc.  
Attn: Wade Chacon, P.E.  
2155 Louisiana Blvd NE, Suite 9500  
Albuquerque, NM 87110  
Phone (505) 830-5400  
Fax (505) 830-5454

The Bidder's attention is specifically directed to the Instructions to Bidders and Special Provisions contained in the Contract Documents. Bidders are encouraged to visit the project site located at the City's **Wastewater Treatment Facility** at **45 Tell Tale Lane, Carlsbad NM**. Contact Joe Harvey, Wastewater Supervisor at (575) 887-5412 to schedule appointments.

Name and Address of Authorizing Officer:

Mathew Fletcher  
Purchasing Manager  
City of Carlsbad  
101 N. Halagueno  
Carlsbad, NM 88221  
(575) 887-1191

Advertised In:  
Carlsbad Current Argus

Advertising Dates:  
May 12, 2015

**END OF ADVERTISEMENT FOR BIDS**



## INSTRUCTIONS TO BIDDERS

### TABLE OF CONTENTS

	Page
ARTICLE 1 – Defined Terms .....	1
ARTICLE 2 – Copies of Bidding Documents .....	1
ARTICLE 3 – Qualifications of Bidders .....	1
ARTICLE 4 – Site and Other Areas; Existing Site Conditions; Examination of Site; Owner’s Safety Program; Other Work at the Site .....	2
ARTICLE 5 – Bidder’s Representations .....	3
ARTICLE 6 – Pre-Bid Conference .....	4
ARTICLE 7 – Interpretations and Addenda.....	4
ARTICLE 8 – Bid Security .....	5
ARTICLE 9 – Contract Times .....	5
ARTICLE 10 – Liquidated Damages.....	5
ARTICLE 11 – Substitute and “Or-Equal” Items.....	6
ARTICLE 12 – Subcontractors, Suppliers, and Others .....	6
ARTICLE 13 – Preparation of Bid .....	6
ARTICLE 14 – Basis of Bid .....	7
ARTICLE 15 – Submittal of Bid.....	7
ARTICLE 16 – Modification and Withdrawal of Bid.....	8
ARTICLE 17 – Opening of Bids .....	8
ARTICLE 18 – Bids to Remain Subject to Acceptance .....	8
ARTICLE 19 – Evaluation of Bids and Award of Contract .....	8
ARTICLE 20 – Bonds and Insurance.....	9
ARTICLE 21 – Signing of agreement .....	9
ARTICLE 22 – Retainage .....	9
ARTICLE 23 – Resident Preference.....	10
ARTICLE 24 – Wage Rate Requirements .....	10



## **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 In order to submit a bid valued at more than \$60,000, the contractor, servicing as a prime or not, shall be registered with the New Mexico Department of Workforce Solutions.

3.02 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and the following additional information:

A. Evidence of Bidder's authority to do business where the Project is located.

B. Bidder's state contractor license number.

C. Bidder's Qualification Statement.

D. New Mexico Department of Workforce Solutions Registration Number.

E. A copy of valid resident contractor or veteran contractor certificate to receive resident or veteran preference.

F. A current Certificate of Insurance must be furnished by the successful bidder in accordance with the Supplementary conditions of this contract.

3.03 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.04 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.05 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.
- 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;

1. The Owner does not have any Subsurface or Hazardous Environmental Conditions reports.
- 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. Due to the nature and complexity of this project, attendance to the pre-Bid conference is mandatory in order to submit a bid. 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.
- 7.03 All questions pertaining to this Bid shall be submitted in writing no later than 7 days prior to the Bid opening and shall be directed to:

HDR Engineering, Inc.  
Attn: Wade Chacon, P.E.  
2155 Louisiana Blvd NE, Suite 9500  
Albuquerque, NM 87110  
Phone (505) 830-5400  
Fax (505) 830-5454  
[wade.chacon@hdrinc.com](mailto:wade.chacon@hdrinc.com)

## **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 Bidder shall list Subcontractors and/or Suppliers proposed. 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 *Lump Sum*

- A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

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 to:

Purchasing Manager  
City of Carlsbad  
P.O. Box 1569  
Carlsbad, NM 88221-1569

- 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 The Purchasing Agent reserves the right to amend and/or cancel the bid invitation prior to the time and date of the bid openings.

#### **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

#### **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. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner shall announce to all bidders a “Base Bid plus alternates” budget after receiving all Bids, but prior to opening them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.
- 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 the Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

## **ARTICLE 22 – RETAINAGE**

- 22.01 There are no provisions for retainage on this project.

## ARTICLE 23 – RESIDENT PREFERENCE

23.01 It will be the sole responsibility to the Bidders requesting consideration for Resident Preference at bid openings to submit to the State Purchasing Agent, the questionnaire for Resident Business or Contractor's Certification and to receive approval and a certification form prior to the bid opening. Requests for consideration for Resident Business or Contractor's Preference after bid opening will not be considered.

- A. To receive a resident contractor preference pursuant to Section 13-4-2 NMSA 1978 or a resident veteran contractor preference pursuant to Section 13-1-21 NMSA 1978, a contractor shall submit with its bid a copy of a valid resident contractor certificate or resident veteran contractor certification issued by the taxation and revenue department. In addition, if the contractor is seeking the resident veteran preference, the contractors shall submit with its bid the veteran preference certificate.
- B. For the purpose of awarding, the following shall apply:
  - 1. A bid submitted by a resident contractor shall be deemed to be five percent lower than the bid actually submitted.
  - 2. A bid submitted by a resident veteran contractor with annual revenues of one million dollars (\$1,000,000) or less to be ten percent lower than the bid actually submitted.
  - 3. A bid submitted by a resident veteran contractor with annual revenues of more than one million dollars (\$1,000,000) but less than five million dollars (\$5,000,000) to be eight percent lower than the bid actually submitted.
  - 4. A bid submitted by a resident veteran contractor with annual revenues of five million dollars (\$5,000,000) or more to be seven percent lower than the bid actually submitted.
  - 5. A public body shall not award a contractor both a resident business preference and a resident veteran business preference.
  - 6. When a joint bid is submitted by a combination of resident veteran, resident or nonresident contractor, the preference shall be calculation in proportion to the percentage of the contract, based on the dollar amount of the bid provided under the contract that will be performed by each business as specified in the joint bid.
  - 7. The preference shall be limited, in any calendar year, to an aggregate of then million dollars (\$10,000,000) in purchased by public bodies from all resident veteran business receiving preferences.

For information on obtaining a resident contractor certification or resident veteran certification, the potential Bidder should contact the State of New Mexico Taxation and Revenue Department, P.O. Box 5373, Santa Fe, New Mexico 87502-5374, telephone (505) 827-0951 or on the web at <http://www.tax.newmexico.gov/forms-and-publications/pages/recently-updated.aspx>.

## ARTICLE 24 – WAGE RATE REQUIREMENTS

24.01 The prevailing wage rates of the State of New Mexico apply to this contract as do any requirements of the State of New Mexico associated with the use of these State Prevailing wages.

## Pre-Bid Inquiry Form

**City of Carlsbad, New Mexico  
Wastewater Treatment Facility  
Effluent Reuse Transfer Pump Station**

All pre-bid inquiries must be submitted in writing at least 7 days prior to the proposal date. Only written questions will receive a response. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda. Fax or mail pre-bid inquiries, as appropriate, to Engineer listed in the Instructions to Bidders.

### **Example Format**

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

Question(s) By:\_\_\_\_\_

Contact Information:\_\_\_\_\_

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

Question No.	Question	Plan Sheet and/or Specification Reference
1		
2		
3		
4		



## BID FORM

### **Bid No. 2015-13**

Project Identification: **City of Carlsbad, New Mexico Wastewater Treatment Facility Effluent Reuse Transfer Pump Station**

Bid Date: **May 29, 2015 at 2:00 P.M. (MDT)**

## TABLE OF CONTENTS

	Page
ARTICLE 1 – Bid Recipient.....	1
ARTICLE 2 – Bidder’s Acknowledgements.....	1
ARTICLE 3 – Bidder’s Representations .....	1
ARTICLE 4 – Bidder’s Certification.....	2
ARTICLE 5 – Basis of Bid .....	3
ARTICLE 6 – Time of Completion.....	5
ARTICLE 7 – Attachments to this Bid.....	5
ARTICLE 8 – Defined Terms .....	5
ARTICLE 9 – Bid Submittal .....	6

## ARTICLE 1 – BID RECIPIENT

- 1.01 This Bid is submitted to:

***City of Carlsbad  
Purchasing Manager  
101 N. Halagueno  
Carlsbad, NM 88221  
(575) 887-1191***

- 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 this Bid and in accordance with the other terms and conditions of the Bidding Documents.

## ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

- 2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.
- 2.02 BIDDER will sign and deliver the required number of counterparts of the AGREEMENT with the Bonds and other documents required by the Bidding Requirements within 15 days after the date of OWNER's Notice of Award.

## ARTICLE 3 – BIDDER'S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:

- A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Date</u>
_____	_____
_____	_____
_____	_____
_____	_____

- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and has satisfied itself as to all 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 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. Bidder has considered 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 any 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. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this 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. Bidder 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 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 confirms that 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 and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and 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 4 – BIDDER'S CERTIFICATION**

##### **4.01 Bidder certifies that:**

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive 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 following price(s):

#### BID PROPOSAL

Bid Item No.	Description (Complete in Place)	Bid Price
<b>Base Bid</b>		
1.0	Mobilization	\$
2.0	Reuse Transfer Pump Station	\$
3.0	Forcemain	\$
4.0	Start-up / Demobilization	\$
<b>Allowances</b>		
AL-1.0	Testing Allowance	\$ <b>5,000.00</b>

Bidder will complete the Work in accordance with the Contract Documents for the following price:

**TOTAL BASE BID PLUS ALLOWANCES (Excluding NMGR):**

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**(WRITTEN)**

(\$ )

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**(WRITTEN)** **(FIGURE)**

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) 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.

### BIDDER'S LIST OF SUBCONTRACTORS

Bidder must list all Subcontractors to be used for when the subcontract amount exceeds the threshold amount of \$5,000.00. Subcontractor's submitting a bid greater than \$60,000 shall be registered with the NM Workforce Solutions. The Listing must include Name, Location of Place of Business and Category of Work that will be done by each Subcontractor on the list. List only one Subcontractor for each category of work. FAILURE TO COMPLY WITH THESE REQUIREMENTS WILL MAKE THE BID NON-RESPONSIVE AND THE BID WILL BE REJECTED. [Use additional sheets if necessary.]

NAME OF SUBCONTRACTOR	LOCATION (ADDRESS) OF PLACE OF BUSINESS	CATEGORY OF WORK	WORKFORCE SOLUTION REGISTRATION NUMBER IF BID IS OVER \$60,000

Firm: \_\_\_\_\_

By (printed): \_\_\_\_\_

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

Signature: \_\_\_\_\_

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

## BIDDER'S LIST OF MAJOR EQUIPMENT SUPPLIERS

Bidder must list the names of major equipment suppliers, which Bidder shall provide. If no manufacturer is listed, Owner has the right to select from approved manufactures listed. Award of Contract is based upon the manufacturers listed and no alternate manufacturers than those listed by Bidder below will be considered.

ITEM	MANUFACTURER
Pumping Equipment: Submersible Non-Clog	

### 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 damages.

### ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01 The following documents are submitted with and made a condition of this Bid:
- Required Bid security
  - Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;
  - NM Contractor's License No.: \_\_\_\_\_
  - NM Department of Workforce Solutions Registration No.: \_\_\_\_\_
  - Required Bidder's Qualification Statement with supporting data
  - Copy of valid resident contractor or veteran contractor certificate to receive resident or veteran preference

### ARTICLE 8 – DEFINED TERMS

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

## ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

By:

*[Signature]*

*[Printed name]*

*(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest:

*[Signature]*

*[Printed name]*

Title:

Submittal Date:

Address for giving notices:

Telephone Number:

Fax Number:

Contact Name and e-mail address:

Bidder's License No.:

*(where applicable)*



## BIDDERS QUALIFICATION STATEMENT

**Completion of this statement is required prior to consideration for contract award**

Project Title: City of Carlsbad, NM Wastewater Treatment Facility Effluent Reuse Transfer Pump Station

Submitted By: \_\_\_\_\_  
(Print or Type Name of Bidder)

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

The undersigned certifies the truth and correctness of all statements and of all answers to questions made hereinafter:

1. How many years has your organization been in business as a utilities contractor?  
\_\_\_\_\_
2. How many years has your organization been in business under its present name? \_\_\_\_\_
3. If a corporation, answer the following:
  - a. Date of Incorporation: \_\_\_\_\_
  - b. State of Incorporation: \_\_\_\_\_
  - c. President's Name: \_\_\_\_\_
  - d. Vice President's Name: \_\_\_\_\_
  - e. Secretary or Clerk's Name: \_\_\_\_\_
  - f. Treasurer's Name: \_\_\_\_\_
4. If individual or partnership, answer the following:
  - a. Date of Organization: \_\_\_\_\_
  - b. Name and Address of all Partners: (State if general or limited partnership)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. If other than corporation or partnership, describe organization and name principals: \_\_\_\_\_

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6. Do you plan to subcontract any part of this project? \_\_\_\_\_ if so, give details: \_\_

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7. Has any construction contract to which you have been a party been terminated by the owner; have you ever terminated work on a project prior to its completion for any reason; has any surety which issued a performance bond on your behalf ever completed the work in its own name or financed such completion on your behalf; has any surety expended any monies in connection with the contract for which they furnished a bond on your behalf? If the answer to any portion of this question is "yes", please furnish details of all such occurrences including name of owner, architect or engineer, and surety, and name and date of project: \_\_\_\_\_

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8. Has any officer or partner of your organization ever been an officer or partner of another organization that had any construction contract terminated by the owner; terminated work on a project prior to its completion for any reason; had any surety which issued a performance bond complete the work in its own name or financed such completion; or had any surety expend any monies in connection with a contract for which they furnished a bond? If the answer to any portion of this question is "yes", please furnish details of all such occurrences, including name of owner, architect or engineer, and surety, and name and date of project. \_

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9. List name of project, owner, architect or engineer, contract amount, percent complete and scheduled completion of the major construction projects your organization has in process on this date: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
10. List name of project, owner, architect or engineer, contract amount, date of completion and percent of work with own forces of the major projects of the same general nature as this project which your organization has completed in the past five years: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
11. List name, address and telephone number of a reference for each project listed under Items 9 and 10 above. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
12. List name and construction experience of the principal individual of your organization: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
13. List the states and categories of construction in which your organization is legally qualified to do business: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

14. List name, address, and telephone number of an individual who represents each of the following and who may be contacted for a financial reference:

a. A surety: \_\_\_\_\_

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

b. A bank: \_\_\_\_\_

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

c. A major material supplier: \_\_\_\_\_

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

15. Attach a financial statement, prepared on an accrual basis, in a form which clearly indicates Bidder's assets, liabilities and net worth:

a. Date of Financial Statement: \_\_\_\_\_

b. Name of Firm preparing Statement: \_\_\_\_\_

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_

Bidder: \_\_\_\_\_  
(Print or Type Name of Bidder)

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

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

(Seal, if Corporation)



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 shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur 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 shall 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 shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall 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 shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall 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 Registered or Certified Mail, return receipt requested, postage pre-paid, and shall 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 shall 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 shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

# AGREEMENT

## BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between \_\_\_\_\_ (“Owner”) and  
\_\_\_\_\_. (“Contractor”).

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: Reuse transfer pump station and forcemain

### ARTICLE 2 – THE PROJECT

- 2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Reuse transfer pump station and forcemain.

### ARTICLE 3 – ENGINEER

- 3.01 The Project has been designed by HDR Engineering, Inc.
- 3.02 The Owner has retained HDR Engineering, Inc. (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

### ARTICLE 4 – CONTRACT TIMES

- 4.01 *Time 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: Days*
- A. Work at the site cannot begin until delivery of all materials and equipment. Once materials and equipment have been delivered, the Work will be substantially completed within 45 calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 75 calendar days after the date when the Contract Times commence to run.
- 4.03 *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 times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. 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 \$1,000.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A 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 Time (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$1,000.00 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.

#### 4.04 *Special Damages*

- A. In addition to the amount provided for liquidated damages, Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

### 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 other than Unit Price Work, a lump sum of: \$ { } .

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

### 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 account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 25<sup>th</sup> 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.

## 6.03 *Final Payment*

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

## **ARTICLE 7 – ( NOT USED)**

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

8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:

- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
- B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, 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. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied 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. 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 Site-related reports and drawings identified in the Contract 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 Contractor; and (3) Contractor's safety precautions and programs.
- F. 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.

- G. 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.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. 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.

## ARTICLE 9 – CONTRACT DOCUMENTS

### 9.01 Contents

- A. The Contract Documents consist of the following:
  - 1. This Agreement (pages 1 to { }, inclusive).
  - 2. Performance bond (pages { } to { } inclusive).
  - 3. Payment bond (pages { } to { } inclusive).
  - 4. Other bonds.
    - a. { } (pages { } to { } inclusive).
  - 5. General Conditions (pages { } to { } inclusive).
  - 6. Supplementary Conditions (pages { } to { } inclusive).
  - 7. Specifications as listed in the table of contents of the Project Manual.
  - 8. Drawings (not attached but incorporated by reference) consisting of { } sheets with each sheet bearing the following general title: { } **[or]** the Drawings listed on the attached sheet index.
  - 9. Addenda (numbers { } to { } inclusive).
  - 10. Exhibits to this Agreement (enumerated as follows):
    - a. Contractor's Bid (pages { } to { } inclusive).
  - 11. 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.
- B. The documents listed in Paragraph 9.01.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 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

## ARTICLE 10 – MISCELLANEOUS

### 10.01 *Terms*

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

### 10.02 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto 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 Documents.

### 10.03 *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.

### 10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall 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.

### 10.05 *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 10.05:
  - 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 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.

10.06 *Other Provisions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, 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:

CONTRACTOR:

\_\_\_\_\_

\_\_\_\_\_

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

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

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

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

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

Attest: \_\_\_\_\_

Attest: \_\_\_\_\_

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

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

Address for giving notices:

Address for giving notices:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

*(where applicable)*

# PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

## CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description *(name and location)*:

## BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:

Amount:

Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

## CONTRACTOR AS PRINCIPAL

## SURETY

\_\_\_\_\_  
Contractor's Name and Corporate Seal

\_\_\_\_\_  
Surety's Name and Corporate Seal

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

By: \_\_\_\_\_  
Signature *(attach power of attorney)*

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

Attest: \_\_\_\_\_  
Signature

Attest: \_\_\_\_\_  
Signature

\_\_\_\_\_  
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 shall be considered plural where applicable.**

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 shall 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 shall 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 shall 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 shall 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 shall 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 shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall 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 shall not be reduced or set off on account of any such unrelated obligations. No right of action shall 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 may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall 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 shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall 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 shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall 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 shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:



# PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

**Attest:** \_\_\_\_\_

Signature

## CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description *(name and location)*:

\_\_\_\_\_  
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 shall be considered plural where applicable.**

## BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:

Amount:

Modifications to this Bond Form: ☐ None ☐

See Paragraph 18

\_\_\_\_\_  
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

## CONTRACTOR AS PRINCIPAL

## SURETY

\_\_\_\_\_  
Contractor's Name and Corporate Seal

\_\_\_\_\_  
Surety's Name and Corporate Seal

**By:** \_\_\_\_\_  
Signature

**By:** \_\_\_\_\_  
Signature *(attach power of attorney)*

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

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 shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 satisfy 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 shall 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 shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall 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 shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall 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:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
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;
4. A brief description of the labor, materials, or equipment furnished;
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;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and

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 shall be 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 shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:



This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

## STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by



Issued and Published Jointly by



These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC's Guide to the Preparation of Supplementary Conditions (EJCDC® C-800, 2013 Edition). The full EJCDC Construction series of documents is discussed in the Commentary on the 2013 EJCDC Construction Documents (EJCDC® C-001, 2013 Edition).

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# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

## TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology .....	1
1.01 Defined Terms .....	1
1.02 Terminology .....	5
Article 2 – Preliminary Matters .....	6
2.01 Delivery of Bonds and Evidence of Insurance .....	6
2.02 Copies of Documents .....	6
2.03 Before Starting Construction .....	6
2.04 Preconstruction Conference; Designation of Authorized Representatives .....	7
2.05 Initial Acceptance of Schedules .....	7
2.06 Electronic Transmittals .....	7
Article 3 – Documents: Intent, Requirements, Reuse .....	8
3.01 Intent .....	8
3.02 Reference Standards .....	8
3.03 Reporting and Resolving Discrepancies .....	8
3.04 Requirements of the Contract Documents .....	9
3.05 Reuse of Documents .....	10
Article 4 – Commencement and Progress of the Work .....	10
4.01 Commencement of Contract Times; Notice to Proceed .....	10
4.02 Starting the Work .....	10
4.03 Reference Points .....	10
4.04 Progress Schedule .....	10
4.05 Delays in Contractor’s Progress .....	11
Article 5 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions .....	12
5.01 Availability of Lands .....	12
5.02 Use of Site and Other Areas .....	12
5.03 Subsurface and Physical Conditions .....	13
5.04 Differing Subsurface or Physical Conditions .....	14
5.05 Underground Facilities .....	15

5.06	Hazardous Environmental Conditions at Site.....	17
Article 6 – Bonds and Insurance .....		19
6.01	Performance, Payment, and Other Bonds .....	19
6.02	Insurance—General Provisions .....	19
6.03	Contractor’s Insurance .....	20
6.04	Owner’s Liability Insurance .....	23
6.05	Property Insurance.....	23
6.06	Waiver of Rights .....	25
6.07	Receipt and Application of Property Insurance Proceeds .....	25
Article 7 – Contractor’s Responsibilities .....		26
7.01	Supervision and Superintendence .....	26
7.02	Labor; Working Hours .....	26
7.03	Services, Materials, and Equipment.....	26
7.04	“Or Equals” .....	27
7.05	Substitutes .....	28
7.06	Concerning Subcontractors, Suppliers, and Others .....	29
7.07	Patent Fees and Royalties .....	31
7.08	Permits .....	31
7.09	Taxes .....	32
7.10	Laws and Regulations.....	32
7.11	Record Documents.....	32
7.12	Safety and Protection.....	32
7.13	Safety Representative .....	33
7.14	Hazard Communication Programs .....	33
7.15	Emergencies .....	34
7.16	Shop Drawings, Samples, and Other Submittals.....	34
7.17	Contractor’s General Warranty and Guarantee.....	36
7.18	Indemnification .....	37
7.19	Delegation of Professional Design Services .....	37
Article 8 – Other Work at the Site .....		38
8.01	Other Work .....	38
8.02	Coordination .....	39
8.03	Legal Relationships.....	39

Article 9 – Owner’s Responsibilities.....	40
9.01 Communications to Contractor.....	40
9.02 Replacement of Engineer .....	40
9.03 Furnish Data .....	40
9.04 Pay When Due.....	40
9.05 Lands and Easements; Reports, Tests, and Drawings .....	40
9.06 Insurance .....	40
9.07 Change Orders.....	40
9.08 Inspections, Tests, and Approvals .....	41
9.09 Limitations on Owner’s Responsibilities .....	41
9.10 Undisclosed Hazardous Environmental Condition.....	41
9.11 Evidence of Financial Arrangements.....	41
9.12 Safety Programs .....	41
Article 10 – Engineer’s Status During Construction.....	41
10.01 Owner’s Representative.....	41
10.02 Visits to Site.....	41
10.03 Project Representative.....	42
10.04 Rejecting Defective Work.....	42
10.05 Shop Drawings, Change Orders and Payments.....	42
10.06 Determinations for Unit Price Work .....	42
10.07 Decisions on Requirements of Contract Documents and Acceptability of Work .....	42
10.08 Limitations on Engineer’s Authority and Responsibilities.....	42
10.09 Compliance with Safety Program.....	43
Article 11 – Amending the Contract Documents; Changes in the Work .....	43
11.01 Amending and Supplementing Contract Documents .....	43
11.02 Owner-Authorized Changes in the Work .....	44
11.03 Unauthorized Changes in the Work .....	44
11.04 Change of Contract Price .....	44
11.05 Change of Contract Times .....	45
11.06 Change Proposals .....	45
11.07 Execution of Change Orders.....	46
11.08 Notification to Surety.....	47
Article 12 – Claims.....	47

12.01	Claims .....	47
Article 13 – Cost of the Work; Allowances; Unit Price Work.....		48
13.01	Cost of the Work .....	48
13.02	Allowances .....	50
13.03	Unit Price Work .....	51
Article 14 – Tests and Inspections; Correction, Removal or Acceptance of Defective Work.....		52
14.01	Access to Work.....	52
14.02	Tests, Inspections, and Approvals .....	52
14.03	Defective Work.....	53
14.04	Acceptance of Defective Work.....	53
14.05	Uncovering Work .....	53
14.06	Owner May Stop the Work .....	54
14.07	Owner May Correct Defective Work.....	54
Article 15 – Payments to Contractor; Set-Offs; Completion; Correction Period .....		55
15.01	Progress Payments .....	55
15.02	Contractor’s Warranty of Title .....	58
15.03	Substantial Completion .....	58
15.04	Partial Use or Occupancy .....	59
15.05	Final Inspection .....	59
15.06	Final Payment.....	59
15.07	Waiver of Claims .....	61
15.08	Correction Period .....	61
Article 16 – Suspension of Work and Termination .....		62
16.01	Owner May Suspend Work .....	62
16.02	Owner May Terminate for Cause .....	62
16.03	Owner May Terminate For Convenience .....	63
16.04	Contractor May Stop Work or Terminate .....	63
Article 17 – Final Resolution of Disputes .....		64
17.01	Methods and Procedures .....	64
Article 18 – Miscellaneous .....		64
18.01	Giving Notice .....	64
18.02	Computation of Times.....	64
18.03	Cumulative Remedies .....	64

18.04	Limitation of Damages .....	65
18.05	No Waiver .....	65
18.06	Survival of Obligations .....	65
18.07	Controlling Law .....	65
18.08	Headings.....	65



## 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 form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting 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, or both; 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, or both; 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; or (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. 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), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree 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 the 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. *Engineer*—The individual or entity named as such in the Agreement.
21. *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.
22. *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. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *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.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
27. *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.
28. *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.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
30. *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.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.
33. *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.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.
35. *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.
36. *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.

37. *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 furnished by Owner which are designated for the use of Contractor.
38. *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.
39. *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.
40. *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 thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, 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.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *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.

48. *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 the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
1. 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:*
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:*
1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
    - a. does not conform to the Contract Documents; or
    - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
    - c. 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 15.04).
- E. *Furnish, Install, Perform, Provide:*
1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean 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, shall mean 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, shall mean 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. 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 Bonds and Evidence of Insurance***

- A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), 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 executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- 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 specifically 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 *Initial 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 for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall 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.

#### 2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items 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 items, or from those established in applicable transmittal protocols.

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

#### **3.01 *Intent***

- A. The Contract Documents are complementary; what is required by one 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 or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall 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.

#### **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, shall mean 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, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, 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, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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 Documents 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 Documents 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 shall 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 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 thereunder.
- 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 give written notice to Owner and Contractor 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 editions, 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 shall preclude 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 thirtieth 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 sixtieth day after the day of Bid opening or the thirtieth 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 shall 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 shall 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 shall 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 the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the 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. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall 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 utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
  4. acts of war or terrorism.
- D. 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.
- E. Paragraph 8.03 governs 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.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times 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.

- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

## **ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

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

- A. Owner shall furnish the Site. Owner shall notify Contractor 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; 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 7.12, 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 at law; 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 shall 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 known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
  - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); 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 upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. 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; or
  - 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.

#### 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 either:
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; or
  2. is of such a nature as to require a change in the Drawings or Specifications; or
  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 the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; 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. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, 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 conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
  - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
  - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
  - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall 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, or both, 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.

#### 5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
  1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
  2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
    - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
    - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
    - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
    - d. 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 in the Contract Documents, or was not shown or indicated 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), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; 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 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. *Possible Price and Times Adjustments:*
  - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, 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. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
    - 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;
    - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
    - d. 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, or both, then any such adjustment shall 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, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
  2. 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 Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. 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; or
  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, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, 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.
- 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 or 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.H shall obligate 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 shall obligate 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 all of Contractor's obligations under the Contract. These bonds shall 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 Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, 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 shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. 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.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

### 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. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

maintaining the policies, coverages, and endorsements 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 and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements 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 and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. 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, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of 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.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect 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 shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

#### 6.03 *Contractor's Insurance*

- A. *Workers' Compensation:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
  - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
  - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
  - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).
- B. *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:
1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
  2. claims for damages insured by reasonably available personal injury liability coverage.
  3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage:
    - a. Such insurance shall 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, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
  3. Broad form property damage coverage.
  4. Severability of interest.
  5. Underground, explosion, and collapse coverage.
  6. Personal injury coverage.
  7. 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); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
  8. 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.
- D. *Automobile liability:* Contractor shall purchase and maintain automobile liability insurance against claims 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 shall be written on an occurrence basis.
- E. *Umbrella or excess liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:
  - 1. include at least the specific coverages provided in this Article.
  - 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
  - 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
  - 4. remain in effect at least until final payment (and longer if expressly required in this Article) 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 Documents.
  - 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed 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.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

#### 6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. 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.

#### 6.05 *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 full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
  - 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
  - 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. 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 may be provided through other insurance policies acceptable to Owner and Contractor.
  - 3. 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.
  - 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. 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).
  6. extend to cover damage or loss to insured property while in transit.
  7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
  8. allow for the waiver of the insurer's subrogation rights, as set forth below.
  9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
  10. not include a co-insurance clause.
  11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
  12. include performance/hot testing and start-up.
  13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed 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.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- 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 notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* 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 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

#### 6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers 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. 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 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 Subcontractors, all individuals or entities identified in the Supplementary Conditions as 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. None of the above waivers shall extend 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. 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:
  - 1. loss 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 perils whether or not insured by Owner; and
  - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner 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.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work 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 any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

#### 6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 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 6.05 shall 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, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

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

### **7.01   *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. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

### **7.02   *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 at all times maintain good discipline and order at the Site.
- B. 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 shall 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.

### **7.03   *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 shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

guarantees required by the Specifications shall 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 shall 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.

#### 7.04 "Or Equals"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, 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 material or equipment, or items from other proposed suppliers under the circumstances described below.
  - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
    - a. in the exercise of reasonable judgment Engineer determines that:
      - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
      - 2) it 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) it has a proven record of performance and availability of responsive service; and
      - 4) it is not objectionable to Owner.
    - b. Contractor certifies that, if approved and incorporated into the Work:
      - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
      - 2) it 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 shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the proposed item as a substitute pursuant to Paragraph 7.05.

#### 7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment 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 material or equipment under the circumstances described below. To the extent possible such requests shall 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 material or equipment from anyone other than Contractor.
  - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.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 material or equipment that Contractor seeks to furnish or use. The application:
    - a. shall 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 that specified, and
      - 3) be suited to the same use as that 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 that specified, and

- 2) available engineering, sales, maintenance, repair, and replacement services.
- d. shall 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 shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities 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, Supplier, or other individual or entity 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 five days.

- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. 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, Suppliers, or other individuals or entities 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, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, 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, Supplier, or other individual or entity, whether initially or as a replacement, shall 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 fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
2. shall create 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.

7.07 *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 a particular 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 shall be disclosed by Owner 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.

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. 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

#### 7.09 *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.

#### 7.10 *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. Except where otherwise expressly required by applicable Laws and Regulations, 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 shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give 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 notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

#### 7.11 *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.

#### 7.12 *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. 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.
- B. 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. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
  - C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
  - D. 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.
  - E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.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).
  - F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
  - G. Contractor's duties and responsibilities for safety and protection shall 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.

#### 7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

#### 7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of 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 threatened 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 thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

#### 7.16 *Shop Drawings, Samples, and Other Submittals*

##### A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
  - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
  - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
  - c. determined and verified 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
  - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall 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 submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

##### 1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings will 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.D.

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.D.

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. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. 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, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. 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 shall 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.
5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 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, shall 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, Sample, or other submittal shall 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.D.4.

E. *Resubmittal Procedures:*

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 submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

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 and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  1. abuse, modification, or improper 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.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
  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. any inspection, test, or approval by others; or
  8. any correction of defective Work by Owner.

- D. 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 shall 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 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 performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury 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 shall 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.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
  - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

#### 7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

## **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 utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. 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.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, 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.

## 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 at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner 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, or both. 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 shall 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. When applicable, any such equitable adjustment in Contract Price shall 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 is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- 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. 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 to 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.
- C. 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 to Contractor.

- D. 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 shall 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 Documents (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 10.08. 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 *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 Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *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.

10.07 *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.

10.08 *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, shall 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 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 10.08 shall also apply to the Resident Project Representative, if any.

#### 10.09 *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 (if any) of which Engineer has been informed.

### **ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK**

#### 11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
  - 1. *Change Orders:*
    - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
    - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not 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, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
  - 2. *Work Change Directives:* 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 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: 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. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

#### 11.02 *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. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes 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 shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate 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.

#### 11.03 *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.

#### 11.04 *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 shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall 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); or
  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 11.04.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 11.04.C).

- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall 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 shall be 15 percent;
    - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five 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 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.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 five 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 shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
    - d. no fee shall 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 will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
    - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

#### 11.05 *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 shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

#### 11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. 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. The supporting data shall 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. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
  2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall 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.
  3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *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 that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

#### 11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the 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 11.02, (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 in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

#### 11.08 *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 shall be submitted 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; and
  - 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.
- 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 shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall be incorporated in a Change Order 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. 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 shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall 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. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, 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, shall 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 shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall 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, who 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 shall 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 for services specifically related to the Work.
5. Supplemental costs including 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, and hand tools not owned by the workers, 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.
  - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the 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 property insurance established in accordance with Paragraph 6.05), 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 shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall 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 shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety 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. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. 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.
- 5. 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:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

## 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 on account of any of the foregoing will be valid.
- C. *Contingency Allowance*: Contractor agrees that a 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 on account of Work covered by allowances, and the Contract Price shall 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, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
  - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
  - 2. there is no corresponding adjustment with respect to any other item of Work; and
  - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

## **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 will 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 therewith 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 shall 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 shall 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 shall 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 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 shall 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 special 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, or both, 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 shall 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 rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven 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 on account of 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. 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 shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and 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.
  2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
  3. 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, or
  - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
  - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
  - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, 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 on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of 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 that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
  - j. liquidated 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;
  - l. there are other items entitling 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 shall 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 shall be treated as an amount due as determined by Paragraph 15.01.C.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 seven 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 shall 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 seven 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 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 6.05 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 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall 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 disputes that Contractor believes are unsettled; 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 Application and Acceptance:***

1. 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 ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall 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. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. 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. *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.
- D. *Payment Becomes Due:*** Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

#### 15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- 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 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 terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then 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 other adjacent areas;
  - 2. correct such defective Work;
  - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, 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 therefrom.
- B. If 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 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 correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. 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.
- D. 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.

- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not 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, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall 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) ten 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) 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 seven 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 shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

#### 16.03 *Owner May Terminate For Convenience*

- A. Upon seven 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 on account of loss of anticipated overhead, profits, or revenue, 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 seven 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, seven 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; and
  - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising 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; or
  - 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 Documents requires the giving of written notice, it will be deemed to have been validly given if:
  - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
  - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

### **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 shall not constitute a waiver of that provision, nor shall 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 or completion of the Contract or termination 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 *Headings*

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



# SUPPLEMENTARY CONDITIONS

## TABLE OF CONTENTS

	<b>Page</b>
ARTICLE 2 – PRELIMINARY MATTERS .....	1
SC- 2.02    Copies of Documents .....	1
SC- 3.01    Intent.....	1
ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS.....	2
SC- 5.03.A    Reports or Drawings.....	2
SC- 5.04    Differing Subsurface or Physical Conditions .....	2
SC- 5.06    Hazardous Environmental Conditions at Site .....	2
ARTICLE 6 – BONDS AND INSURANCE.....	2
SC- 6.02    Insurance—General Provisions .....	2
SC- 6.03    Contractor’s Liability Insurance .....	2
SC- 6.05    Property Insurance.....	3
ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES.....	4
SC- 7.01    Supervision and Superintendence .....	4
SC- 7.02    Labor; Working Hours .....	4
SC- 7.03    Services, Materials, and Equipment.....	5
SC- 7.18    Indemnification .....	5
ARTICLE 9 – OWNER’S RESPONSIBILITIES .....	5
SC- 9.13    Owner’s Site Representative.....	5
ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION.....	8
SC- 10.03    Project Representative.....	8
ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK.....	9
SC- 13.01    Cost of the Work .....	9
ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD .....	9
SC- 15.03    Substantial Completion.....	9
SC- 15.07    Waiver of Claims .....	9
ARTICLE 17 – FINAL RESOLUTION OF DISPUTES .....	10
SC- 17.02    Arbitration.....	10
SC- 17.03    Attorneys’ Fees .....	11



## I. SUPPLEMENTARY CONDITIONS

### A. *Caption and Introductory Statements*

#### **Supplementary Conditions**

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition). All provisions that are not so amended or supplemented remain in full force and effect.

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 thereto.

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## ARTICLE 2 – PRELIMINARY MATTERS

### SC-2.02 *Copies of Documents*

**SC-2.02.A. Amend the first sentence of Paragraph 2.02.A. to read as follows:**

**Owner shall furnish to Contractor 2 copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Contractor shall be responsible for printing Contract Drawings and any additional copies.**

### SC-3.01 *Intent*

**SC-3.01 Add the following new paragraphs immediately after Paragraph 3.01.E:**

- F. The Specifications may vary in form, format and style. Some specification sections are written in varying degrees of streamlined or declarative style and some sections may be relatively narrative by comparison. Omissions of such words and phrases as "the Contractor shall," "in conformity with," "as shown," or "as specified" are intentional in streamlined sections. Omitted words and phrases shall be supplied by inference. Similar types of provisions may appear in various parts of a section or articles within a part depending on the format of the section. The Contractor shall not take advantage of any variation of form, format or style in making claims for extra Work.
- G. The cross referencing of specification sections under the subparagraph heading "Related Sections include but are not necessarily limited to:" and elsewhere within each specification section is provided as an aid and convenience to the Contractor. The Contractor shall not rely on the cross referencing provided and shall be responsible to coordinate the entire Work under the Contract Documents and provide a complete Project whether or not the cross referencing is provided in each section or whether or not the cross referencing is complete.

## ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

### SC-5.03.A *Reports or Drawings*

**Add the following sentence. No subsurface investigations were performed for this project.**

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

**Delete paragraphs A-D and Add the following sentence. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition**

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

**Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:**

- A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.**
- B. Not Used.**

## ARTICLE 6 – BONDS AND INSURANCE

### SC-6.02 *Insurance—General Provisions*

**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.**

### SC-6.03 *Contractor's Liability Insurance*

**SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:**

**K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:**

- 1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:**

<b>State:</b>	<u>Statutory</u>
<b>Federal, if applicable (e.g., Longshoreman's):</b>	<u>Statutory</u>
<b>Employer's Liability:</b>	<u>\$ 1,000,000</u>

**2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:**

General Aggregate \$ 1,000,000

Products - Completed Operations Aggregate \$ 1,000,000

Each Occurrence (Bodily Injury and Property Damage) \$ 1,000,000

**3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:**

**Bodily Injury:**

Each person \$ 1,000,000

Each accident \$ 1,000,000

**Property Damage:**

Each accident \$ 1,000,000

*[or]*

Combined Single Limit of \$ 1,000,000

**4. Excess or Umbrella Liability:**

Per Occurrence \$ 1,000,000

General Aggregate \$ 1,000,000

**SC-6.05** *Property Insurance*

**SC-6.05.** Add the following to the list of requirements in Paragraph 6.05.A, as a numbered item:

13. be subject to a deductible amount of no more than [\$\_\_\_\_\_] for direct physical loss in any one occurrence.

**SC-6.05.A.1** Add the following new subparagraph after subparagraph 6.05.A.1:

- a. In addition to Owner, Contractor, and all Subcontractors, include as insureds the following:

*[Here list by name (not category, role, or classification) other persons or entities to be included on the builder's risk policy as insureds.]*

**SC-6.05.A.** Add the following to the list of items in Paragraph 6.05.A, as numbered items:

14. include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorneys fees and engineering or other consultants' fees, if not otherwise covered;

16. 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:

- a. *[here list specific items of equipment and purchase value]*
- b. *[here list items of material and purchase value]*

17. include by express endorsement coverage of damage to Contractor's equipment.

**SC-6.05.A.** Delete Paragraph 6.05.A of the General Conditions and substitute the following in its place:

Contractor shall provide and maintain installation floater insurance for property under the care, custody, or control of Contractor. The installation floater insurance shall be a broad form or "all risk" policy providing coverage for all materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work. Coverage under the Contractor's installation floater will include:

- 1. any loss to property while in transit,
- 2. any loss at the Site, and
- 3. any loss while in storage, both on-site and off-site.

Coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable. The Contractor will be solely responsible for any deductible carried under this coverage and claims on materials, supplies, machinery, fixture, and equipment that will be incorporated into the Work while in transit or in storage. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

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

### *SC-7.01 Supervision and Superintendence*

**SC-7.01.B.** Amend Paragraph 7.01.B to add the following sentences: "The Contractor shall identify their representative at the Site that shall have authority to act on behalf of Contractor. All communications given to or received from this representative shall be binding on Contractor."

**SC-7.01.C.** Add the following new paragraph immediately after Paragraph 7.01.B:

Any superintendent or other personnel, who repeatedly fails to follow the Engineer's written or oral orders, directions, instructions, or determinations, shall be subject to removal from the project. Upon the written request of the Engineer, the Contractor shall immediately remove such superintendent or other personnel and name a replacement in writing. Noncompliance with the Engineer's request to remove and replace personnel at any level shall be grounds for terminating the Contract.

### *SC-7.02 Labor; Working Hours*

**SC-7.02.B.** Add the following new subparagraphs immediately after Paragraph 7.02.B:

- 1. Regular working hours will be Monday thru Friday 7:00 am to 4:00 pm

**2. Owner's legal holidays are:**

- Christmas
- New Years
- Memorial Day
- 4<sup>th</sup> July
- Labor Day
- Thanksgiving

**SC-7.02.C. Add the following new paragraph immediately after Paragraph 7.02.B:**

Contractor 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.

*SC-7.03 Services, Materials, and Equipment*

**SC-7.03.B. Add the following new subparagraphs immediately after Paragraph 7.03.B:**

1. Where the Work requires equipment be furnished, due to the lack of standardization of equipment as produced by the various manufacturers, it may become necessary to make minor modifications in the structures, buildings, piping, mechanical work, electrical work, accessories, controls, or other work, to accommodate the particular equipment offered. Contractor's bid price for any equipment offered shall include the cost of making any necessary changes subject to the approval of Engineer.

*SC-7.18 Indemnification*

**SC 7.18.A Amend the second sentence of Paragraph 7.18.A by striking out "negligent".**

**ARTICLE 9 – OWNER'S RESPONSIBILITIES**

*SC-9.13 Owner's Site Representative*

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

**SC-9.13 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. The authority and responsibilities of Owner's Site Representative follow:**

1. **General: OSR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. OSR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. OSR**

shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.

2. **Schedules:** Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.
3. **Conferences and Meetings:** Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.
4. **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 proper execution of the Work.
5. **Interpretation of Contract Documents:** Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
6. **Shop Drawings and Samples:**
  - a. Record date of receipt of Samples and Contractor-approved Shop Drawings.
  - b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.
  - c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which OSR believes that the submittal has not been approved by Engineer.
7. **Modifications:** Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with OSR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.
8. **Review of Work and Rejection of Defective Work:**
  - a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
  - b. Report to Engineer whenever OSR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed

Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that OSR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

**9. Inspections, Tests, and System Start-ups:**

- a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
- b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

**10. Records:**

- a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.
- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
- c. Maintain records for use in preparing Project documentation.

**11. Reports:**

- a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
- b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
- c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

**12. Payment Requests:** Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. **Certificates, Operation and Maintenance Manuals:** During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.
14. **Completion:**
  - a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
  - b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
  - c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

**C. The OSR shall 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 Contractor's work.
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. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

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

### **SC-10.03**    *Project Representative*

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

B. On this Project, by agreement with the Owner, 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.

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

##### *SC-13.01 Cost of the Work*

**SC 13.01.B.5.c Delete Paragraph 13.01.B.5.c in its entirety and insert the following in its place:**

**c. Construction Equipment and Machinery:**

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.**
- 2) Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the Blue Book Rental Rate. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include 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, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than \$1,000 will be considered small tools.**

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

##### *SC-15.03 Substantial Completion*

**SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:**

- 1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or 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.**

##### *SC-15.07 Waiver of Claims*

**SC-15.07.B. Amend Paragraph 15.07.B to state "The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner and/or Engineer other than those pending matters that have been duly submitted.**

## ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

### SC-17.02 Arbitration

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

#### **SC-17.02 Arbitration**

- A.** All matters subject to final resolution under this Article will be decided by arbitration in accordance with the rules of *[insert name of selected arbitration agency]*, subject to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into 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 arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall 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. The demand for arbitration should include specific reference to Paragraph SC-17.02.D below.
- C.** No arbitration arising out of or relating to the Contract shall 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 is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and
  - 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.
- D.** The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.
- E.** 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.
- F.** The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

SC-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.]*

**SC-17.03 Attorneys' Fees:** 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.



## NOTICE OF AWARD

---

Date of Issuance:

Owner:

Owner's Contract No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

Bidder:

Bidder's Address:

### TO BIDDER:

You are notified that Owner has accepted your Bid dated [ ] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

\_\_\_\_\_  
*[describe Work, alternates, or sections of Work awarded]*

The Contract Price of the awarded Contract is: \$ [ ] *[note if subject to unit prices, or cost-plus]*

[ ] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. *[revise if multiple copies accompany the Notice of Award]*

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner [ ] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

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 Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

---

Owner:

Authorized Signature

By:

Title:

Copy: Engineer



---

**NOTICE TO PROCEED**

---

Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:
	Effective Date of Contract:

---

**TO CONTRACTOR:**

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [\_\_\_\_\_, 20\_\_]. *[see Paragraph 4.01 of the General Conditions]*

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, [the date of Substantial Completion is \_\_\_\_\_, and the date of readiness for final payment is \_\_\_\_\_] **or** [the number of days to achieve Substantial Completion is \_\_\_\_\_, and the number of days to achieve readiness for final payment is \_\_\_\_\_].

Before starting any Work at the Site, Contractor must comply with the following:  
*[Note any access limitations, security procedures, or other restrictions]*

---

Owner:

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer



**Work Change Directive No.**

Date of Issuance:

Effective Date:

Owner:

Owner's Contract No.:

Contractor:

Contractor's Project No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments: *[List documents supporting change]*

**Purpose for Work Change Directive:**

Directive to proceed promptly with the Work described herein, prior to agreeing to changes on Contract Price and Contract Time, is issued due to: *[check one or both of the following]*

- ☐ Non-agreement on pricing of proposed change.
- ☐ Necessity to proceed for schedule or other Project reasons.

**Estimated Change in Contract Price and Contract Times (non-binding, preliminary):**

Contract Price	\$	[increase] [decrease].
----------------	----	------------------------

Contract Time	days	[increase] [decrease].
---------------	------	------------------------

**Basis of estimated change in Contract Price:**

- |   |                                     |
|---|-------------------------------------|
| <input type="checkbox"/> Lump Sum         | <input type="checkbox"/> Unit Price |
| <input type="checkbox"/> Cost of the Work | <input type="checkbox"/> Other      |

RECOMMENDED:

AUTHORIZED BY:

RECEIVED:

By:

Engineer (Authorized Signature)

By:

Owner (Authorized Signature)

By:

Contractor (Authorized Signature)

Title:

Title:

Title:

Date:

Date:

Date:

Approved by Funding Agency (if applicable)

By:

Date:

Title:



**Field Order No.** \_\_\_\_\_

Date of Issuance:

Effective Date:

Owner:

Owner's Contract No.:

Contractor:

Contractor's Project No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

Contractor is hereby directed to promptly execute this Field Order, issued in accordance with General Conditions Paragraph 11.01, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

\_\_\_\_\_  
Specification(s)

\_\_\_\_\_  
Drawing(s) / Detail(s)

Description:

Attachments:

**ISSUED:**

**RECEIVED:**

By:

\_\_\_\_\_  
Engineer (Authorized Signature)

By:

\_\_\_\_\_  
Contractor (Authorized Signature)

Title:

Title:

Date:

Date:

Copy to: Owner



Change Order No. \_\_\_\_\_

Date of Issuance:

Effective Date:

Owner:

Owner's Contract No.:

Contractor:

Contractor's Project No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

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

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i>
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ____ to No. ____: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. ____ to No. ____: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____ Engineer (if required)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable)

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

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



**Contractor's Application for Payment No.**

Application Period:		Application Date:
To (Owner):	From (Contractor):	Via (Engineer):
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

**Application For Payment**

**Change Order Summary**

Approved Change Orders			1. ORIGINAL CONTRACT PRICE..... \$
Number	Additions	Deductions	2. Net change by Change Orders..... \$
			3. Current Contract Price (Line 1 ± 2)..... \$
			4. TOTAL COMPLETED AND STORED TO DATE
			(Column F total on Progress Estimates)..... \$
			5. RETAINAGE:
			a. X Work Completed..... \$
			b. X Stored Material..... \$
			c. Total Retainage (Line 5.a + Line 5.b)..... \$
			6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c)..... \$
			7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)..... \$
			8. AMOUNT DUE THIS APPLICATION..... \$
			9. BALANCE TO FINISH, PLUS RETAINAGE
			(Column G total on Progress Estimates + Line 5.c above)..... \$
TOTALS			
NET CHANGE BY			
CHANGE ORDERS			

**Contractor's Certification**

The undersigned Contractor certifies, to the best of its knowledge, the following:  
 (1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;  
 (2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all Liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such Liens, security interest, or encumbrances); and  
 (3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

**Contractor Signature**

By:	Date:
-----	-------

Payment of: \$ \_\_\_\_\_  
 (Line 8 or other - attach explanation of the other amount)

is recommended by: \_\_\_\_\_  
 (Engineer) (Date)

Payment of: \$ \_\_\_\_\_  
 (Line 8 or other - attach explanation of the other amount)

is approved by: \_\_\_\_\_  
 (Owner) (Date)

Approved by: \_\_\_\_\_  
 Funding or Financing Entity (if applicable) (Date)



## CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: Contractor: Engineer: Project:	Owner's Contract No.: Contractor's Project No.: Engineer's Project No.: Contract Name:
--	---

**This [preliminary] [final] Certificate of Substantial Completion applies to:**

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

### 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.

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 shall be as provided in the Contract, except as amended as follows: *[Note: 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.]*

Amendments to Owner's responsibilities: ☐ None  
☐ As follows

Amendments to Contractor's responsibilities: ☐ None  
☐ As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

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.

EXECUTED BY ENGINEER:	RECEIVED:	RECEIVED:
By: _____ (Authorized signature)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____



**SUSANA MARTINEZ  
GOVERNOR**



**CELINA BUSSEY  
SECRETARY**

**JOHN SANCHEZ  
LT. GOVERNOR**

**STATE OF NEW MEXICO  
DEPARTMENT OF WORKFORCE SOLUTIONS  
121 Tijeras Ave NE Suite 3000  
Albuquerque, NM 87102  
Telephone (505) 841-4405  
Fax (505) 841-4424**

## **PUBLIC WORKS PROJECT REQUIREMENTS**

As a participant in a Public Works project valued at more than \$60,000 in the State of New Mexico, the following list addresses many of the responsibilities that are assigned by statute to each project stakeholder.

### **Contracting Agency**

- Ensure that all contractors/prime contractors wishing to bid on a Public Works project when the project is \$60,000 or more are actively registered with the Labor Relations Division, Labor Enforcement Fund (LEF) prior to bidding.
- Provide completed Notice of Award (NOA) and Sub-Contractor list to Labor Relations Division promptly after the project is awarded.
- Provide updates to the Sub-Contractor list to the Labor Relations Division

### **General Contractor**

- Provide to the Contracting Agency within 3 (Three) days of award a complete sub-contractor list and Statements of Intent (SOI) to pay Prevailing Wages for each contractor.
- Ensure that all sub-contractors wishing to bid on a Public Works project when their portion is over \$60,000 are actively registered with the Labor Relations Division prior to bidding.
- Submit bi-weekly certified payrolls to the owner/contracting agency.
- Make certain NM Apprenticeship and Training Fund payments are to be paid either to an approved Apprenticeship program or to the Labor Relations Division.
- Confirm the Wage Rate poster, provided by the Labor Relations Division, is displayed at the job site in an easily accessible place.
- Make sure, when a project has been completed, the Affidavits of Wages Paid (AWP) is sent to the Contracting Agency.

### **Sub-Contractor**

- Ensure that all sub-contractors wishing to bid on a Public Works project when their portion is over \$60,000 are actively registered with the Labor Relations Division prior to bidding.
- Submit bi-weekly certified payrolls to the General Contractor(s).
- Make certain NM Apprenticeship and Training Fund payments are to be paid either to an approved Apprenticeship program or to the Labor Relations Division.

## **Additional Information**

Reference material and forms for these requirements are available through the following New Mexico Workforce Solutions Web Link.

[www.dws.state.nm.us/new/Labor\\_Relations/publicworks.html](http://www.dws.state.nm.us/new/Labor_Relations/publicworks.html).

## **Additional Information**

Additional information, requirements, and documents on these topics can be found through the Public Works web pages.

- Labor Enforcement Fund (LEF)
- Weekly Certified Payroll
- Public Works Apprenticeship and Training Fund (PWAT)
- Forms: Statement of Intent (SOI), Affidavit of Wages Paid (AWP)
- Prevailing Wage Rates (Base Rates, Fringe, and Apprenticeship Contributions)

## **CONTACT INFORMATION**

Contact us for any questions relating to Public Works Projects.

Kim Kew [Kim.Kew@state.nm.us](mailto:Kim.Kew@state.nm.us) or 505-841-4405

Otis Caddy [LynnO.Caddy@state.nm.us](mailto:LynnO.Caddy@state.nm.us) 505-841-4406

Stacey Lowrey [Stacey.Lowrey@state.nm.us](mailto:Stacey.Lowrey@state.nm.us) 505-841-4412

Violet Miera [Violet.Miera2@state.nm.us](mailto:Violet.Miera2@state.nm.us) 505-841-4418

New Mexico Department of Workforce Solutions

Public Works

121 Tijeras Ave. NE, Suite 3000, Albuquerque, NM 87102

Phone: (505)-841-4400 fax to: (505) 841-4424 or Email to: [public.works@state.nm.us](mailto:public.works@state.nm.us)

Wage Decision # **ED-15-0633 A**

**NOTIFICATION OF AWARD (NOA)**

**THIS WAGE DECISION # EXPIRES FOR BIDS ON**

**09/05/15**

**Description and Location of Work:** WWTF Effluent Reuse Transfer Pump Station

Project includes excavation, backfilling, precast concrete, pump and accessories, reuse transfer forcemain and electrical for a new pump station to transfer treated effluent reuse water.

City of Carlsbad

County of Eddy

45 Tell Tale Lane

**REMINDER for Agency Conducting BID Process:**

After the Contracting Agency awards this project the Wage Rate Poster, Sub-List and the Project Requirement Document, excluding this NOA must be delivered to the **GENERAL/PRIME CONTRACTOR**. The Contracting Agency or its agent must complete this form and submit with the sub-list listing all of the subcontractors including all tiers of subcontractors and fax or email it to the address above. **If the project is canceled**, this form must be completed by the Contracting agency conducting the bid process and the wording "Cancelled" written on the form and send to the Labor Relations Division. Failure to submit the NOA in a timely manner is a violation of paragraph 11.1.2.9.B (3) of the Public Works Minimum Wage Act Policy Manual.

General/Prime Contractor Company Name: \_\_\_\_\_ License#: \_\_\_\_\_

Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_

Project Contact's name: \_\_\_\_\_ E-Mail: \_\_\_\_\_

Approximate Date Work to Start: \_\_\_\_\_

Estimated Completion Date: \_\_\_\_\_

Estimated Cost of Project: \_\_\_\_\_

Bid Opening Date: \_\_\_\_\_

Note: The General/Prime Contractor **MUST** mail/fax in their Statement of Intent to Pay Prevailing Wages to the Contracting Agency or its agent before beginning work on the project. Each Subcontractor (and all tiers of subcontractors) **MUST** also mail/fax their Statement of Intent to Pay Prevailing Wages to the General/Prime Contractor 3 days after award of project. After work on the project is completed **and before, final payment**, is made to subcontractors and all tiers of subcontractors, the contractor and subcontractors must mail/fax their Affidavit of Wages paid to the Contracting Agency for final payment.

**Signature for Contracting Agency (or agent)** \_\_\_\_\_

**Printed Name** \_\_\_\_\_

**Email address for Contracting Agency (not agent)** \_\_\_\_\_ **Required Field**

**Date** \_\_\_\_\_

## SUBCONTRACTOR LIST

**DO NOT** list suppliers or professional services (such as surveyors)  
**INCLUDE** individual subcontractor dollar amount for project

Email to: [public.works@state.nm.us](mailto:public.works@state.nm.us) or fax to: (505) 841-4424

Please include **2nd & 3rd Tier** subcontractors. Make extra copies of form if necessary.

Wage Decision. # **ED-15-0633 A**

### **General Contractor:**

---

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
E-Mail Address: \_\_\_\_\_ License No.: \_\_\_\_\_  
Phone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_ Sub \_\_\_\_\_ 2<sup>nd</sup> TIER \_\_\_\_\_ 3<sup>rd</sup> TIER \_\_\_\_\_  
(To Whom) (To Whom)  
Work to be performed: \_\_\_\_\_ Start Date: \_\_\_\_\_ Amount (\$): \_\_\_\_\_

---

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
E-Mail Address: \_\_\_\_\_ License No.: \_\_\_\_\_  
Phone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_ Sub \_\_\_\_\_ 2<sup>nd</sup> TIER \_\_\_\_\_ 3<sup>rd</sup> TIER \_\_\_\_\_  
(To Whom) (To Whom)  
Work to be performed: \_\_\_\_\_ Start Date: \_\_\_\_\_ Amount (\$): \_\_\_\_\_

---

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
E-Mail Address: \_\_\_\_\_ License No.: \_\_\_\_\_  
Phone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_ Sub \_\_\_\_\_ 2<sup>nd</sup> TIER \_\_\_\_\_ 3<sup>rd</sup> TIER \_\_\_\_\_  
(To Whom) (To Whom)  
Work to be performed: \_\_\_\_\_ Start Date: \_\_\_\_\_ Amount (\$): \_\_\_\_\_

---

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
E-Mail Address: \_\_\_\_\_ License No.: \_\_\_\_\_  
Phone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_ Sub \_\_\_\_\_ 2<sup>nd</sup> TIER \_\_\_\_\_ 3<sup>rd</sup> TIER \_\_\_\_\_  
(To Whom) (To Whom)  
Work to be performed: \_\_\_\_\_ Start Date: \_\_\_\_\_ Amount (\$): \_\_\_\_\_

---

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
E-Mail Address: \_\_\_\_\_ License No.: \_\_\_\_\_  
Phone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_ Sub \_\_\_\_\_ 2<sup>nd</sup> TIER \_\_\_\_\_ 3<sup>rd</sup> TIER \_\_\_\_\_  
(To Whom) (To Whom)  
Work to be performed: \_\_\_\_\_ Start Date: \_\_\_\_\_ Amount (\$): \_\_\_\_\_

---

Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
E-Mail Address: \_\_\_\_\_ License No.: \_\_\_\_\_  
Phone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_ Sub \_\_\_\_\_ 2<sup>nd</sup> TIER \_\_\_\_\_ 3<sup>rd</sup> TIER \_\_\_\_\_

Work to be performed:

Start Date:

(To Whom)

(To Whom)

Amount (\$):

---

Revised 8/23/13

Page 2 of 2



**WWTF Effluent Reuse Transfer Pump Station: Wage Decision: ED-15-0633 A**

Project includes excavation, backfilling, precast concrete, pump and accessories, reuse transfer forcemain and electrical for a new pump station to transfer treated effluent reuse water.

**TYPE "A" - STREET, HIGHWAY, UTILITY & LIGHT ENGINEERING**

*Effective January 1, 2015*

Trade Classification	Base Rate	Fringe Rate
Bricklayer/Blocklayer/Stonemason	17.74	0.26
Carpenter/Lather	15.99	0.44
Cement Mason	15.52	0.26
Ironworker	21.77	6.03
Painter (Brush/Roller/Spray)	17.56	0.44
<b>Electricians (outside)</b>		
Groundman	26.79	11.03
Equipment Operator	29.61	11.03
Lineman/Wireman or Tech	30.20	11.03
Cable Splicer	31.38	11.03
Plumber/Pipefitter	28.30	4.07
<b>Laborers</b>		
Group I	13.73	0.35
Group II	14.03	0.35
Group III	14.43	0.35
<b>Operators</b>		
Group I	15.74	0.26
Group II	15.94	0.26
Group III	16.52	0.26
Group IV	16.54	0.26
Group V	16.53	0.26
Group VI	16.69	0.26
Group VII	16.74	0.26
Group VIII	16.89	0.26
Group IX	17.39	0.26
Group X	18.19	0.26
<b>Truck Drivers</b>		
Group I	13.32	0.26
Group II	13.52	0.26
Group III	13.72	0.26
Group IV	13.92	0.26

**NOTE: SUBSISTENCE AND INCENTIVE PAY DO NOT APPLY TO TYPE "A" CONSTRUCTION.**



# Table of Contents

## **DIVISION 01 - GENERAL REQUIREMENTS**

01 11 20	JOB CONDITIONS
01 22 00	MEASUREMENT AND PAYMENT
01 25 13	PRODUCT SUBSTITUTIONS
01 26 31	REQUESTS FOR INFORMATION (RFI)
01 30 00	SPECIAL CONDITIONS
01 32 17	CONSTRUCTION PROGRESS SCHEDULE
01 33 00	SUBMITTALS
01 33 04	OPERATIONS AND MAINTENANCE MANUALS
01 35 05	ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS
01 42 13	STANDARD ABBREVIATIONS AND SYMBOLS
01 61 05	MAJOR EQUIPMENT SUPPLIERS
01 65 50	PRODUCT DELIVERY, STORAGE, AND HANDLING
01 73 20	OPENINGS AND PENETRATIONS IN CONSTRUCTION
01 74 13	CLEANING
01 75 00	SYSTEM START-UP

## **DIVISION 03 – CONCRETE**

03 09 00	CONCRETE
----------	----------

## **DIVISION 05 – METALS**

05 50 00	METAL FABRICATIONS
----------	--------------------

## **DIVISION 09 - FINISHES**

09 91 00	PAINTING AND PROTECTIVE COATINGS
09 56 52	CONCRETE PROTECTIVE COATINGS

## **DIVISION 10 - SPECIALTIES**

10 14 00	IDENTIFICATION DEVICES
----------	------------------------

## **DIVISION 26 - ELECTRICAL**

26 05 00	ELECTRICAL: BASIC REQUIREMENTS
26 05 19	WIRE AND CABLE - 600 VOLT AND BELOW
26 05 26	GROUNDING
26 05 33	RACEWAYS AND BOXES
26 05 43	ELECTRICAL: EXTERIOR UNDERGROUND
26 26 13	PACKAGE POWER SUPPLY
26 27 26	WIRING DEVICES
26 28 00	OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES
26 28 17	SEPARATELY MOUNTED CIRCUIT BREAKERS

## **DIVISION 27 - COMMUNICATIONS**

27 21 00	TELEMETRY SYSTEMS
----------	-------------------

**DIVISION 31 - EARTHWORK**

31 10 00	SITE CLEARING
31 21 33	TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES
31 23 00	EARTHWORK

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

32 91 05	TOPSOILING AND FINISHED GRADING
----------	---------------------------------

**DIVISION 33 – UTILITIES**

33 05 16	PRECAST CONCRETE MANHOLE STRUCTURES
----------	-------------------------------------

**DIVISION 40 – PROCESS INTERCONNECTIONS**

40 05 05	EQUIPMENT: BASIC REQUIREMENTS
40 05 13	PIPE AND FITTINGS: BASIC REQUIREMENTS
40 05 23	VALVES: BASIC REQUIREMENTS
40 20 16	PIPE: DUCTILE
40 20 23	PIPE: PLASTIC
40 50 10	PLUG VALVES
40 90 00	INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS
40 91 10	PRIMARY METERS AND TRANSMITTERS
40 98 00	CONTROL PANELS AND ENCLOSURES
40 99 00	SURGE PROTECTION DEVICES (SPD) FOR INSTRUMENTATION AND CONTROL EQUIPMENT

**DIVISION 43 – LIQUID HANDLING EQUIPMENT**

43 21 00	PUMPING EQUIPMENT: BASIC REQUIREMENTS
43 21 22	PUMPING EQUIPMENT: SUBMERSIBLE NON-CLOG

**SECTION 01 11 20**  
**JOB CONDITIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Job conditions.
    - a. The work required described in these documents includes the following:
      - 1) New effluent reuse transfer pump station and forcemain
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.

**1.2 PROJECT CONDITIONS**

- A. Prior to installation of material, equipment and other work, verify with subcontractors, material or equipment manufacturers, and installers that the substrate or surface to which those materials attach is acceptable for installation of those materials or equipment. (Substrate is defined as building surfaces to which materials or equipment is attached to i.e., floors, walls, ceilings, etc.).
- B. Correct unacceptable substrate until acceptable for installation of equipment or materials.
- C. Maintaining Facility Operations:
  - 1. Facility is currently operating.
  - 2. Ensure construction activities do not interfere with Owner's operation of facility.
  - 3. Planned facility shut downs are permitted on the following schedule. Contractor shall coordinate with Owner all facility shut downs.
    - a. Effluent Reuse Wet Well
      - 1) Coordinate with owner to take down and drain effluent reuse wet well.

**PART 2 - PRODUCTS – (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**PART 3 - EXECUTION – (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**END OF SECTION**



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

**PART 1 - MEASUREMENT**

**1.1 GENERAL**

- A. Payment for materials furnished and work done under the contract will be made as hereinafter stipulated, for actual amount of materials furnished and work performed under authorization of the OWNER and in accordance with actual measurements.

B. BID ITEMS:

The following items, classifying the various kinds of work refer to the respective items listed in the bid proposal and cover all items required to provide the owner with a complete project considered to be incidental to the Base Bid. Any work elements not listed but are necessary for a complete project are considered incidental even though they are not specifically listed below.

All of the following items include construction staking; coordination; overtime; restoration; spare parts; start-up; training; overtime; field offices, field office equipment; utilities; project overhead; construction sign and all other materials, equipment and labor incidental thereto.

**1.2 BASE BID ITEMS**

A. BID ITEMS

1. BID ITEM 1.0 MOBILIZATION

- a. Payment will be made for Mobilization at the stipulated Lump Sum price indicated in the Bid Proposal. Bid shall include but not be limited to the following: bonds; insurance; mobilization of forces; preconstruction conference; setting up trailers, staging areas; and all other materials, equipment and labor incidental thereto.

2. BID ITEM 2.0 PUMP STATION:

- a. Payment will be made for new pump station at the stipulated Lump Sum price indicated in the Bid Proposal. Price Bid shall include but not be limited to the following: clear and grub, excavation, backfill, surface restoration, precast wet well and valve vault, submersible pumps, valves, fittings, pipe, connection to existing wet well, appurtenances, cable holders, level sensor, floats, supports, electrical and instrumentation, control panels, protective coatings; warranties, O&M manuals, training, Record Drawings, spare parts, cleaning and all other materials, equipment and labor incidental thereto.

3. BID ITEM 3.0 FORCEMAIN:

- a. Payment will be made for the new forcemain at the stipulated Lump Sum price indicated in the Bid Proposal. Price Bid shall include but not be limited to the following: clear and grub, trench and backfill, surface restoration, pipe, air release valve, warranties, O&M manuals, training, Record Drawings, spare parts, cleaning and all other materials, equipment and labor incidental thereto.

4. BID ITEM 4.0 START-UP /DEMOBILIZATION:

- 1 a. Payment will be made for Start-Up/ Demobilization at the stipulated Lump Sum price  
2 indicated in the Bid Proposal. Price Bid shall include but not be limited to the following:  
3 equipment startup and testing, temporary, training, video taping, and labor incidental thereto.

4 B. ALLOWANCES

5 The following items refer to the respective Allowance items listed in the bid proposal.  
6

7 1. ALLOWANCE AL-1-0 TESTING ALLOWANCE:

- 8 a. Payment will be made for actual costs for passing tests of soils and concrete. The contractor  
9 will be reimbursed for actual costs based on submitted invoices. No additional compensation  
10 will be allowed for delays or inconvenience caused by testing.  
11  
12

13 **END OF SECTION**

**SECTION 01 25 13**  
**PRODUCT SUBSTITUTIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. The procedure for requesting the approval of substitution of a product that is not equivalent to a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:
    - a. Name of manufacturer.
    - b. Name of vendor.
    - c. Trade name.
    - d. Catalog number.
  2. Substitutions are not "or-equals."
  3. This Specification Section does not address substitutions for major equipment.
    - a. See "INSTRUCTIONS TO BIDDERS."
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
- C. Request for Substitution - General:
1. Base all bids on materials, equipment, and procedures specified.
  2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers.
    - a. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are "or-equals," as determined by Engineer.
  3. Other types of equipment and kinds of material may be acceptable substitutions under the following conditions:
    - a. Or-equals are unavailable due to strike, discontinued production of products meeting specified requirements, or other factors beyond control of Contractor; or,
    - b. Contractor proposes a cost and/or time reduction incentive to the Owner.

**1.2 QUALITY ASSURANCE**

- A. In making request for substitution or in using an approved product, Contractor represents Contractor:
1. Has investigated proposed product, and has determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended.
  2. Will provide same guarantee for substitute item as for product specified.
  3. Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
  4. Waives all claims for additional costs related to substitution which subsequently arise.

**1.3 DEFINITIONS**

- A. Product: Manufactured material or equipment.

**1.4 PROCEDURE FOR REQUESTING SUBSTITUTION**

- A. Substitution shall be considered only:
1. After Award of Contract.

- 1           2. Under the conditions stated herein.
- 2       B. Written request through Contractor only.
- 3       C. Transmittal Mechanics:
- 4           1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01
- 5               33 00.
- 6               a. Product substitution will be treated in a manner similar to "deviations," as described in
- 7               Specification Section 01 33 00.
- 8               b. List the letter describing the deviation and justifications on the transmittal form in the
- 9               space provided under the column with the heading DESCRIPTION.
- 10              1) Include in the transmittal letter, either directly or as a clearly marked attachment,
- 11              the items listed in Paragraph D below.
- 12       D. Transmittal Contents:
- 13           1. Product identification:
- 14               a. Manufacturer's name.
- 15               b. Telephone number and representative contact name.
- 16               c. Specification Section or Drawing reference of originally specified product, including
- 17               discrete name or tag number assigned to original product in the Contract Documents.
- 18           2. Manufacturer's literature clearly marked to show compliance of proposed product with
- 19               Contract Documents.
- 20           3. Itemized comparison of original and proposed product addressing product characteristics
- 21               including but not necessarily limited to:
- 22               a. Size.
- 23               b. Composition or materials of construction.
- 24               c. Weight.
- 25               d. Electrical or mechanical requirements.
- 26           4. Product experience:
- 27               a. Location of past projects utilizing product.
- 28               b. Name and telephone number of persons associated with referenced projects
- 29               knowledgeable concerning proposed product.
- 30               c. Available field data and reports associated with proposed product.
- 31           5. Data relating to changes in construction schedule.
- 32           6. Data relating to changes in cost.
- 33           7. Samples:
- 34               a. At request of Engineer.
- 35               b. Full size if requested by Engineer.
- 36               c. Held until substantial completion.
- 37               d. Engineer not responsible for loss or damage to samples.

## 38   **1.5 APPROVAL OR REJECTION**

- 39       A. Written approval or rejection of substitution given by the Engineer.
- 40       B. Engineer reserves the right to require proposed product to comply with color and pattern of
- 41       specified product if necessary to secure design intent.
- 42       C. In the event the substitution is approved, the resulting cost and/or time reduction will be
- 43       documented by Change Order in accordance with the General Conditions.
- 44       D. Substitution will be rejected if:
- 45           1. Submittal is not through the Contractor with his stamp of approval.
- 46           2. Request is not made in accordance with this Specification Section.
- 47           3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
- 48           4. In the Engineer's opinion, substitution will not perform adequately the function consistent
- 49           with the design intent.

- 1 E. Contractor shall reimburse Owner for the cost of Engineer's evaluation whether or not  
2 substitution is approved.

3 **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

4 **PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

5 **END OF SECTION**



**SECTION 01 26 31**  
**REQUESTS FOR INFORMATION (RFI)**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Specification Section specifies administrative and procedural requirements for handling and processing Requests for Information (RFI).
- B. RFI is intended for requesting clarifications and interpretations of Contract Documents due to apparent inconsistencies, errors or omissions in Contract Documents, and due to unanticipated existing conditions.
- C. RFI is not intended for general communication, requesting substitutions, Contractor's proposed changes, resolution of nonconforming work, or coordination between contractors or for general questions not related to Contract Documents.
- D. RFI process is intended to be a cooperative effort between Engineer and Contractor to expedite responses to RFIs and maintain progress of Work without utilizing other lengthy procedures.
- E. Any other proposed method of processing RFIs other than indicated within this Specification Section shall be evaluated by Engineer for potential impact on Engineer's services.
  - 1. If Engineer agrees to utilize another proposed method, Engineer will be reimbursed for any special training, usage fees, extra time required to implement, maintain, utilize and administer such a system.

**1.2 RFI SUBMITTAL PROCEDURE**

- A. All RFIs shall be submitted on the form attached to this Specification Section, or on mutually agreeable forms to be provided at the preconstruction meeting, and shall include all backup information.
  - 1. Backup information shall include, but not be limited to Contractor verified field measurements, quantities, dimensions, installation requirements, materials, catalog number, and any other information that will assist the Owner in reviewing the RFI.
- B. Within ten (10) working days of receipt of RFI, Engineer will either return a response to the RFI or notify Contractor when a response will be issued.

**1.3 COMMENCEMENT OF RFI-RELATED WORK**

- A. No portion of the work requiring instruction from the Engineer shall begin until RFI has been reviewed by the Engineer and returned to Contractor with instruction or with notation indicating Engineer response is not necessary.

**PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**PART 3 - EXECUTION**

**3.1 REQUESTS FOR INFORMATION**

- A. Review of Contract Documents and Field Conditions:
  - 1. Before starting each portion of Work, Contractor shall carefully study and compare various Drawings, Specifications and other Contract Documents, coordination drawings, Shop Drawings, prior correspondence or documentation relative to that portion of Work, as well as information furnished by Owner.
  - 2. Contractor and Subcontractors shall evaluate and take field measurements of conditions related to that portion of Work and shall observe any conditions at site affecting it.

3. These obligations are for purpose of facilitating coordination and construction by Contractor.
  4. Any errors, inconsistencies or omissions discovered in Contract Documents shall be reported promptly to Engineer as a properly prepared and timely RFI.
- B. Contractor's and Subcontractor's Responsibilities:
1. When interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor, Subcontractor, Vendor or Supplier, the request shall be processed through Contractor.
    - a. Review request for completeness, quality, proper referencing to Drawing or Specification Section and reason submitted.
    - b. If request is not acceptable, it shall be returned to submitter with comments regarding reason for being returned.
    - c. Make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions.
    - d. Respond to RFI accordingly if review of RFI discloses a response or is related to coordination of construction or other issue not related to Contract Documents.
    - e. If unable to respond to request, it shall be restated in clear, concise, correct, complete and easily understood manner, and rewritten if necessary, additional information included if necessary, and only then submitted to Engineer for response.
  2. Follow these procedures in developing an RFI:
    - a. List specific Contract Documents researched when seeking information being requested.
    - b. Reference all applicable Contract Drawings by sheet number, section, detail, room number, door number, etc., Specifications by section and paragraph number, and reference any other relevant documents.
    - c. The field titled "Regarding" on attached RFI form must be clear for future reference in reports or correspondence.
    - d. Clearly state request and provide Contract Document references and any additional information needed so request can be fully understood, including sketches, photos or other reference material.
    - e. Fully assess issues, suggest any reasonable solutions and include various factors, including potential costs, schedule impacts, if any, and recommendations which will aid in determining a solution or response.
      - 1) If a reasonable solution can not be suggested, a statement to that effect should be so stated.
    - f. Indicate reason request is being submitted.
    - g. Any critical RFI's requiring a rapid response shall clearly indicate such with an explanation as to why RFI is critical.
    - h. Priority for responses shall be indicated when multiple RFI's are submitted within short period of time.
  3. Copies of responses to RFI's shall be distributed to all parties affected.
  4. A response to RFI shall not be considered a notice to proceed with a change that may revise the Contract Sum or Contract Time, unless authorized by Owner in writing.
  5. If response to RFI is determined incomplete, it shall be resubmitted with reason response is unacceptable and any necessary additional information within five (5) days of time of receipt of response to RFI.
- C. RFI Submittal Numbering:
1. RFI's shall be assigned unique numbers in sequential order (1, 2, 3, 4, etc.).
  2. A resubmitted RFI or a previously answered RFI requiring revising or further clarification shall be submitted using original RFI number proceeded by ".1" to indicate revision one of RFI (i.e.: RFI No. 34.1 for revision 1 to RFI No. 34).
  3. Engineer may return RFI without response for following reasons:
    - a. Request is unclear or incomplete.
    - b. Detailed information not provided.

- 1 c. Is related to construction means, methods or techniques.
- 2 d. Is related to health or safety measures.
- 3 e. Is due to Contractor's lack of adequate coordination.
- 4 f. Is for coordination between Subcontractors.
- 5 g. Is considered a "Substitution Request."
- 6 h. Is considered a "Contractor Proposed Change."
- 7 i. Is due to non-conformance.
- 8 j. Response is required by another party.

9 **END OF SECTION**

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**REQUEST FOR INFORMATION FORM**

Contractor's RFI No. \_\_\_\_\_ Engineer's RFI No. \_\_\_\_\_

Contract: \_\_\_\_\_

Contractor: \_\_\_\_\_

Owner: \_\_\_\_\_ Owner's Contract No. \_\_\_\_\_

Engineer **HDR Engineering, Inc.** \_\_\_\_\_ Engineer's Contract No. \_\_\_\_\_

THIS REQUEST BY: \_\_\_\_\_ cc to: \_\_\_\_\_  
(Name of the Contractor's Representative)

REFERENCE: DIVISION \_\_\_\_\_ SECTION \_\_\_\_\_ PLAN SHEET NO. \_\_\_\_\_

ATTACHMENTS \_\_\_\_\_

INTERPRETATION BY: \_\_\_\_\_ Date: \_\_\_\_\_, 20\_\_\_\_  
(Name of the Engineer's Representative)

ATTACHMENTS \_\_\_\_\_

The General Conditions specifies that once the Engineer provides a response to a Contractor's RFI, that determination shall be final and binding on the Contractor unless the Contractor delivers to the Owner written notice of a change in the work within a certain period of time of receipt of that determination. See the GCs for further clarification.

cc to: \_\_\_\_\_  
\_\_\_\_\_



**SECTION 01 30 00**  
**SPECIAL CONDITIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Administrative and procedural requirements for:
    - a. Preconstruction Conference.
    - b. Contractor's Superintendent's Field Office.
    - c. Drawings and Contract Documents for Contractor use.
    - d. Testing.
    - e. Schedule of Values.
    - f. Project meetings.
    - g. Special considerations related to adjacent properties and facilities.
    - h. Historical and archaeological finds.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.

**1.2 PRECONSTRUCTION CONFERENCE**

- A. A preconstruction conference shall be held at the project site after award of Contract.
  - 1. Engineer will notify the Contractor as to the date and time of the conference two (2) weeks in advance of the proposed date.
  - 2. Contractor's Project Manager and Project Superintendent and Contractor's Subcontractor Representatives shall attend.

**1.3 PROJECT SIGNS**

- A. Coordinate sign locations with Owner.
- B. Signs not listed in this Specification Section permitted only upon approval of Owner.

**1.4 CONTRACTOR'S SUPERINTENDENT'S FIELD OFFICE**

- A. Establish at site of Project.
- B. Equipment: Telephone, telecopy, mailing address, and sanitary facilities.
- C. Assure attendance at this office during the normal working day.
- D. At this office, maintain complete field file of Shop Drawings, posted Contract Drawings and Specifications, and other files of field operations including provisions for maintaining "As Recorded Drawings."
- E. Remove field office from site upon acceptance of the entire work by the Owner.

**1.5 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE**

- A. Refer to General Conditions.
- B. Electronic drawings and specifications will be provided to Contractor. Contractor shall be responsible for reproduction of contract documents as needed.
- C. Additional documents after "no-charge" documents will be furnished to Contractor at cost.

## 1.6 TESTING

- A. Contractor shall hire certified testing lab to perform materials testing. Contractor shall be responsible for all coordination with testing lab.
- B. Payment for Soil, Concrete and Other Testing:
  - 1. Soils and concrete testing:
    - a. The Owner will pay for "Passing" soils and "Passing" concrete tests on the Project.
    - b. Costs of corrective action, costs of "Failing" soils and concrete tests, and cost of testing associated with establishment of mix design are the sole responsibility of the Contractor.
  - 2. Other testing: Required testing, testing procedures, reports, certificates, and costs associated with all phases of securing required satisfactory test information which may be required by individual Specification Sections or Drawings are the full responsibility of the Contractor.

## 1.7 SCHEDULE OF VALUES

- A. Where a Contract is awarded on a lump sum basis, the Contractor shall file with the Engineer a balanced price segregation of the lump sum bid into items similar to the various subdivisions of the general and detailed specifications, the sum of which shall equal the lump sum bid.
  - 1. The cost of various materials shall be furnished upon request of the Engineer, and such data will then be used as a basis for making progress estimates.
  - 2. Breakdown costs, itemized by Specification Section and trade, and distribute cost to individual applicable units and structures.
  - 3. Where structures, units, equipment or other components are identified by a specific series or, identification number, utilize said designation throughout cost breakdown.
  - 4. Provide detailed breakdown for individual yard piping or conduit runs and identify approximate quantities involved to satisfaction of the Engineer.
  - 5. Provide separate breakdown for change order items requested.
  - 6. Provide an additional breakdown sheet, equivalent to the Stored Material Summary of EJCDC document C620, showing the tabulation format for stored materials.
  - 7. Submit this sheet each month with Contractor's pay request breakdown.
  - 8. The detail and format of cost breakdown and stored materials tabulation sheet shall be fully approved by Engineer.
- B. A reasonable allocation of the Contract Price to the component parts of the Work will be approved if component parts of the Work have values assigned to them that are well-balanced with respect to relative values for similar work established by published estimating guides.
  - 1. Unless otherwise agreed to at the Preconstruction Conference, Means Estimator Guide or other similar nationally recognized estimating guide shall be used for resolving differences between Engineer's and Contractor's opinions of allocation of values.
  - 2. Consent of Surety: If Contractor and Engineer cannot mutually agree on a Schedule of Values, Engineer will approve a Schedule of Values approved by the Surety providing the Performance Bond.
- C. Contractor's costs shall not govern the allocation of values when application of Contractor's costs to a component part of the Work results in any other component part or combination of component parts being under-valued in relation to conventional estimating guides.
- D. Schedule of Values shall be agreed upon prior to first Application for Payment.

## 1.8 PROJECT MEETINGS

- A. Construction Meetings:
  - 1. The Engineer will conduct construction meetings involving:
    - a. Contractor's project manager.
    - b. Contractor's project superintendent.
    - c. Owner's designated representative(s).
    - d. Engineer's designated representative(s).

- 1 e. Contractor's subcontractors as appropriate to the Work in progress.
- 2 f. Owner's Construction Quality Control Consultant.
- 3 2. Meetings will be conducted monthly.
- 4 3. The Engineer will take meeting minutes and submit copies of meeting minutes to
- 5 participants and designated recipients identified at the Preconstruction Conference.
- 6 a. Corrections, additions or deletions to the minutes shall be noted and addressed at the
- 7 following meeting.
- 8 4. The Engineer will schedule meetings for most convenient time frame.
- 9 5. The Engineer will have available at each meeting full chronological files of all previous
- 10 meeting minutes.
- 11 6. The Contractor shall have available at each meeting up-to-date record drawings.
- 12 B. Pre-Installation Conferences:
- 13 1. Coordinate and schedule with Resident Project Representative and Engineer for each
- 14 material, product or system specified.
- 15 a. Conferences to be held prior to initiating installation, but not more than two (2) weeks
- 16 before scheduled initiation of installation.
- 17 b. Conferences may be combined if installation schedule of multiple components occurs
- 18 within the same two (2) week interval.
- 19 c. Review manufacturers recommendations and Contract Documents Specification
- 20 Sections.
- 21 2. Contractor's Superintendent and individual who will actually act as foreman of the
- 22 installation crew (installer), if other than the Superintendent, shall attend.

#### 23 **1.9 SPECIAL CONSIDERATIONS RELATED TO ADJACENT PROPERTIES AND**

#### 24 **FACILITIES**

- 25 A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements
- 26 required to enable transportation of materials to the site.
- 27 B. Maintain conditions of access road to site such that access is not hindered as the result of
- 28 construction related deterioration.
- 29 1. Provide daily sweeping of hard-surface roadways to remove soils tracked onto roadway.

#### 30 **1.10 HISTORICAL AND ARCHAEOLOGICAL**

- 31 A. If during the course of construction, evidence of deposits of historical or archeological interest is
- 32 found, the Contractor shall cease operations affecting the find and shall notify Owner.
- 33 1. No further disturbance of the deposits shall ensue until the Contractor has been notified by
- 34 Owner that Contractor may proceed.
- 35 2. Owner will issue a notice to proceed after appropriate authorities have surveyed the find and
- 36 made a determination to Owner.
- 37 3. Compensation to the Contractor, if any, for lost time or changes in construction resulting
- 38 from the find, shall be determined in accordance with changed or extra work provisions of
- 39 the Contract Documents.
- 40 4. The site has been previously investigated and has no known history of historical or
- 41 archaeological finds.

#### 42 **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

#### 43 **PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**



**SECTION 01 32 17**  
**CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Specific requirements for the preparation, submittal, updating, status reporting and management of the construction Progress Schedule.
- B. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms and Conditions of the Contract.
  - 2. Division 01 - General Requirements.

**1.2 DEFINITIONS**

- A. The following definitions shall apply to this Specification Section:
  - 1. **BASELINE SCHEDULE:** The initial as-bid, detailed Progress Schedule prepared by the Contractor to define its plan for constructing the Project as required by the Contract Documents, and accepted by the Owner or Engineer as meeting the requirements of the Contract Documents for specified constraints, sequences, milestones and completion dates.
  - 2. **WORKING SCHEDULE:** A schedule developed from the Baseline Schedule to indicate the Contractor's plan for executing the Work, and providing for schedule recovery when approved time extensions are not sufficient to provide for timely completion due to Contractor inefficiencies beyond the control of the Owner or outside the risks accepted by the Owner.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Baseline Schedule: Submitted within 30 days after Effective Date of Agreement.
  - 3. Working Schedules.

**1.4 GENERAL REQUIREMENTS**

- A. Construction operations will be scheduled to allow the Owner uninterrupted operation of existing adjacent facilities.
  - 1. Coordinate connections with existing work to ensure timely completion of interfaced items.
- B. At no time shall Contractor or his employees modify operation of the existing facilities or start construction modifications without approval of the Owner except in emergency to prevent or minimize damage.
- C. Within 10 days after award of Contract, submit for approval a bar/Gantt Chart or critical path type schedule.
  - 1. Account for schedule of Subcontracts.
  - 2. Include proper sequence of construction, various crafts, purchasing time, Shop Drawing approval, material delivery, equipment fabrication, startup, demonstration, and similar time consuming factors.
  - 3. Show on schedule as a minimum, earliest starting, earliest completion, latest starting, latest finish, and free and total float for each task or item.

- 1 D. By preparing and submitting the Baseline Schedule, the Contractor represents that it can and  
2 intends to execute the Work and portions thereof within the specified times and constraints and  
3 that its bid covers the costs associated with the execution of the Work in accordance with the  
4 Construction Schedule.

5 **1.5 SUBMITTAL PACKAGES**

6 A. Schedules:

- 7 1. Bar/Gantt Chart or CPM time-scaled network diagram:  
8 a. Three (3) prints of each sheet.  
9 b. Minimum sheet size: 11 IN x 17 IN.  
10 2. Supporting data:  
11 a. Three (3) sets of a list of project activities including the following:  
12 1) Holidays that will be observed during construction.  
13 2) Number of planned working days and shifts per week.

14 **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

15 **PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

16 **END OF SECTION**

**SECTION 01 33 00**  
**SUBMITTALS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Mechanics and administration of the submittal process for:
    - a. Shop Drawings.
    - b. Samples.
    - c. Informational submittals.
  - 2. General content requirements for Shop Drawings.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Operations and Maintenance Manual submittal requirements are specified in Specification Section 01 33 04.
  - 4. Specification Sections in Division 01 through Division 46 identifying required submittals.

**1.2 DEFINITIONS**

- A. Shop Drawings:
  - 1. See General Conditions.
  - 2. Product data and samples are Shop Drawing information.
  - 3. Initial and Revised Construction Baseline Schedules.
  - 4. Schedule of Values.
- B. Informational Submittals:
  - 1. Submittals other than Shop Drawings and samples required by the Contract Documents that do not require approval.
  - 2. Representative types of informational submittal items include but are not limited to:
    - a. Construction Record Schedules (progress schedules).
    - b. HVAC test and balance reports.
    - c. Installed equipment and systems performance test reports.
    - d. Manufacturer's installation certification letters.
    - e. Instrumentation and control commissioning reports.
    - f. Warranties.
    - g. Service agreements.
    - h. Construction photographs.
    - i. Survey data.
    - j. Health and safety plans.
    - k. Work plans.
    - l. Delegated designs per performance specification requirements
  - 3. For-Information-Only submittals upon which the Engineer is not expected to conduct review or take responsive action may be so identified in the Contract Documents.

**1.3 SUBMITTAL SCHEDULE**

- A. Schedule of Shop Drawings:
  - 1. Submitted and approved within 14 days of receipt of Notice to Proceed.
  - 2. Account for multiple transmittals under any Specification Section where partial submittals will be transmitted.
  - 3. Submittal and approval prior to 50 percent completion.
- B. Informational Submittals:

- 1 1. Reports and installation certifications submitted within five (5) working days of conducting
- 2 testing or examination.
- 3 C. The submittal schedule shall include the following columns as a minimum:
- 4

Submittal Section	Submittal Description	Planned Submittal Date	Submittal Need Date	Actual Submittal Date	Actual Return Date	Disposition
----------------------	-----------------------	------------------------------	------------------------	-----------------------------	--------------------------	-------------

5

#### 6 **1.4 PREPARATION OF SUBMITTALS**

- 7 A. Legibility:
  - 8 1. All submittals and all pages of all copies of a submittal shall be completely legible.
  - 9 2. Submittals which, in the Engineer's sole opinion, are illegible will be returned without
  - 10 review.
- 11 B. Shop Drawings and Samples:
  - 12 1. Scope of any submittal and letter of transmittal:
    - 13 a. Limited to one (1) Specification Section.
    - 14 b. Do not submit under any Specification Section entitled (in part) "Basic Requirements"
    - 15 unless the product or material submitted is specified, in total, in a "Basic Requirements"
    - 16 Specification Section.
  - 17 2. Numbering letter of transmittal:
    - 18 a. Use the Specification Section number followed by a series number ("-xx" and
    - 19 beginning with "01"); increase the series number sequentially with each additional
    - 20 transmittal for that Specification Section.
  - 21 3. Describing transmittal contents:
    - 22 a. Provide listing of each component or item in submittal capable of receiving an
    - 23 independent review action.
    - 24 b. Identify for each item:
      - 25 1) Manufacturer and Manufacturer's Drawing or data number.
      - 26 2) Contract Document tag number(s).
      - 27 3) Unique page numbers for each page of each separate item.
    - 28 c. When submitting "or-equal" items that are not the products of named manufacturers,
    - 29 include the words "or-equal" in the item description.
  - 30 4. Contractor certification of review and approval:
    - 31 a. Contractor's review and approval certification stamp shall be applied either to the letter
    - 32 of transmittal.
      - 33 1) Stamp may be either a wet ink stamp or electronically embedded.
      - 34 2) Clearly identify the person who reviewed the submittal and the date it was
      - 35 reviewed.
      - 36 3) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied
      - 37 Contractor's obligations under the Contract Documents with respect to Contractor's
      - 38 review and approval as stipulated in the General Conditions."
    - 39 b. Submittals containing multiple independent items shall be prepared with each item
    - 40 listed on the letter of transmittal or on an index sheet for all items listing the discrete
    - 41 page numbers for each page of each item, which shall be stamped with the Contractor's
    - 42 review and approval stamp.
      - 43 1) Each independent item shall have a cover sheet with the transmittal number and
      - 44 item number recorded.
        - 45 a) Provide clear space of 3 IN SQ for Engineer stamping.
      - 46 2) Individual pages or sheets of independent items shall be numbered in a manner that
      - 47 permits the entire contents of a particular item to be readily recognized and
      - 48 associated with Contractor's certification.

5. Resubmittals:
  - a. Number with original Specification Section and series number with a suffix letter starting with "A" on a (new) duplicate transmittal form.
  - b. Do not increase the scope of any prior transmittal.
  - c. Account for all components of prior transmittal.
    - 1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
      - a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
    - 2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
      - a) Obtain Engineer's approval to exclude items.
6. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide three (3) copies of each submittal for Engineer plus the number required by the Contractor.
  - a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed three (3).
  - b. All other size sheets:
    - 1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.
    - 2) Utilize mailing tube; do not fold.
    - 3) The Engineer will mark and return the reproducible to the Contractor for reproduction and distribution.
7. Contractor shall not use red color for marks on transmittals.
  - a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
  - b. Engineer will use red marks or enclose marks in a cloud.
8. Transmittal contents:
  - a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
  - b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.
    - 1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.
  - c. Identify equipment or material project application, tag number, Drawing detail reference, weight, and other Project specific information.
  - d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
  - e. Do not modify the manufacturer's documentation or data except as specified herein.
  - f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages.
    - 1) Indicate exact item or model and all options proposed.
  - g. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
    - 1) Arrange data and performance information in format similar to that provided in Contract Documents.
    - 2) Provide, at minimum, the detail specified in the Contract Documents.
  - h. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.
9. Samples:
  - a. Identification:

- 1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, Specification Section or Drawing detail reference, color, range, texture, finish and other pertinent data.
- 2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
- b. Include application specific brochures, and installation instructions.
- c. Provide Contractor's review and approval certification stamp or Contractor's Submittal Certification form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
- d. Resubmit revised samples of rejected items.

C. Informational Submittals:

1. Prepare in the format and detail specified in Specification requiring the informational submittal.

## 1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings and Samples:

1. Transmit all submittals to:

HDR Engineering, Inc.  
2155 Louisiana Blvd. NE Suite 9500  
Albuquerque, NM 87110-5483  
Attn: Wade Chacon, PE

2. Utilize two (2) copies of attached Exhibit A to transmit all Shop Drawings and samples.
3. All submittals must be from Contractor.
  - a. Submittals will not be received from or returned to subcontractors.

B. Informational Submittals:

1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in triplicate or as specified in individual Specification Section.
3. Transmit to:

HDR Engineering, Inc.  
2155 Louisiana Blvd. NE Suite 9500  
Albuquerque, NM 87110-5483  
Attn: Wade Chacon, PE

4. Provide copy of letter of transmittal without attachments to Owner's Resident Project Representative.
  - a. Exception for concrete, soils compaction and pressure test reports.
    - 1) Transmit one (1) copy of test reports to Resident Project Engineer.
    - 2) Transmit one (1) copy of test reports to location and individual indicated above for other informational submittals.

C. Electronic Transmission of Submittals:

1. Transmittals may be made electronically.
  - a. Use commercial project collaboration application or by email.
  - b. Protocols and processes will be determined at the Pre-Construction Conference.
2. Scan all transmittals into Adobe Acrobat Portable Document Format (PDF), latest version, with printing enabled.
  - a. Do not password protect or lock the PDF document.
  - b. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
3. Required signatures may be applied prior to scanning for transmittal.

## 1.6 ENGINEER'S REVIEW ACTION

### A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one (1) of the following actions:
  - a. A - FURNISH AS SUBMITTED.
  - b. B - FURNISH AS NOTED (BY ENGINEER).
  - c. C - REVISE AND RESUBMIT.
  - d. D - REJECTED.
  - e. E - ENGINEER'S REVIEW NOT REQUIRED.
2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
  - a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned without any action.
3. In relying on the representation on the Contractor's review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
  - a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
    - 1) Review and approval will be limited to the single item described on the transmittal letter.
    - 2) Other items identified in the submittal will:
      - a) Not be logged as received by the Engineer.
      - b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
      - c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
  - b. Engineer, at Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
    - 1) Unless Contractor notifies Engineer in writing that the Engineer's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.
4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
  - a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
  - b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
  - a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
    - 1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
      - a) Correct and resubmit items so marked.
  - b. Items marked "A" or "B" will be fully distributed.
  - c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
    - 1) This is at the sole discretion of the Engineer.
    - 2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."

- 1                   3) Distribution to the Owner and field will not be made (unless previously agreed to  
2                   otherwise).
- 3           6. Failure to include any specific information specified under the submittal paragraphs of the  
4           Specifications will result in the submittal being returned to the Contractor with "C" or "D"  
5           Action.
- 6           7. Calculations required in individual Specification Sections will be received for information  
7           purposes only, as evidence calculations have been performed by individuals meeting  
8           specified qualifications, and will be returned stamped "E. Engineer's Review Not Required"  
9           to acknowledge receipt.
- 10          8. Contractor shall furnish required submittals with sufficient information and accuracy to  
11          obtain required approval of an item with no more than two submittals. Engineer will record  
12          Engineer's time for reviewing a third or subsequent submittal of a Shop Drawings, sample,  
13          or other item requiring approval, and Contractor shall be responsible for Engineer's charges  
14          to Owner for such time. Owner may impose a set-off against payments due to Contractor to  
15          secure reimbursement for such charges.
- 16          9. Transmittals of submittals which the Engineer considers as "Not Required" submittal  
17          information, which is supplemental to but not essential to prior submitted information, or  
18          items of information in a transmittal which have been reviewed and received "A" or "B"  
19          action in a prior submittal, will be returned with action "E. Engineer's Review Not  
20          Required."
- 21          10. Samples may be retained for comparison purposes.
- 22              a. Remove samples when directed.
- 23              b. Include in bid all costs of furnishing and removing samples.
- 24          11. Approved samples submitted or constructed, constitute criteria for judging completed work.
- 25              a. Finished work or items not equal to samples will be rejected.

26           **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

27           **PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

28                                   **END OF SECTION**



EXHIBIT A

# Shop Drawing Transmittal

No. \_\_\_\_\_ - \_\_\_\_\_  
(Spec Section) (Series)

Project Name:		Date Received:			
Project Owner:		Checked By:			
Contractor:	HDR Engineering, Inc.		Log Page:		
Address:	Address:	HDR No.:			
		Spec Section:			
		Drawing/Detail No.:			
Attn:	Attn:	1st. Sub	ReSub.		
Date Transmitted:		Previous Transmittal Date:			
Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*
Remarks:					
* The Action designated above is in accordance with the following legend:					

A - Furnish as Submitted

B - Furnish as Noted

C - Revise and Submit

1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
4. Not enough copies submitted.
5. Wrong sequence number.
6. Wrong resubmittal number.
7. Wrong spec. section.
8. Wrong form used.
9. See comments.

D - Rejected

E - Engineer's review not required

1. Submittal not required.
2. Supplemental Information. Submittal retained for informational purposes only.
3. Information reviewed and approved on prior submittal.
4. See comments.
5. Delegated Design - Submittal received as requested by the Contract Documents. The Engineer did not review the engineering or technical content of the submittal.

Engineer's review and approval is limited to determine whether items covered by this submittal will, after installation or incorporation in the Work, conform in general to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.

Comments:

By		Date			
Distribution:	Contractor	File	Field	Owner	Other

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**SECTION 01 33 04**  
**OPERATION AND MAINTENANCE MANUALS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Administration of the submittal process for Operation and Maintenance Manuals.
  - 2. Content requirements for Operation and Maintenance Manuals.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. General submittal requirements are specified in Specification Section 01 33 00 - Submittals.
  - 4. Sections in Division 01 through Division 46 identifying required Operation and Maintenance Manual submittals.

**1.2 DEFINITIONS**

- A. Equipment Operation and Maintenance Manuals:
  - 1. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.
- B. Building Materials and Finishes Operation and Maintenance Manuals:
  - 1. Contain the information required for proper installation and maintenance of building materials and finishes.

**1.3 SUBMITTALS**

- A. List of all the Operation and Maintenance Manuals required by the Contract as identified in Division 01 through Division 46.
- B. Operation and Maintenance Manuals:
  - 1. Draft and final electronic copies.
  - 2. Final paper copies: Three (3) and electronic format (PDF).

**1.4 SUBMITTAL SCHEDULE**

- A. Draft Operation and Maintenance Manuals:
  - 1. Submit approvable draft manuals in electronic format (PDF) after approval of the respective Shop Drawing.
    - a. Include placeholders or fly sheet pages where information is not final or is missing from the draft manual.
  - 2. All Draft Operation and Maintenance Manuals shall be received by no later than 50 percent project completion.
- B. Final Operation and Maintenance Manuals:
  - 1. Final approval of Operation and Maintenance Manuals in electronic format (PDF) must be obtained 14 days prior to equipment start-up.
  - 2. Provide paper copies and CD-ROMs of approved final Operation and Maintenance Manuals in electronic format (PDF), a minimum of 14 days prior to equipment start-up.
  - 3. Issue addenda to Final Approved Operation and Maintenance Manual to include:
    - a. Equipment data that requires collection after start-up, for example but not limited to HVAC balancing reports, electrical switchgear, automatic transfer switch and circuit breaker settings.
    - b. Equipment field testing data.
    - c. Equipment start-up reports.

## 1.5 PREPARATION OF SUBMITTALS

### A. General:

1. All pages of the Operation and Maintenance Manual submittal shall be legible.
  - a. Submittals which, in the Engineer's sole opinion, are illegible will be rejected without review.
2. Identify each equipment item in a manner consistent with names and identification numbers used in the Contract Documents, not the manufacturer's catalog numbers.
3. Neatly type any data not furnished in printed form.
4. Operation and Maintenance Manuals are provided for Owner's use, to be reproduced and distributed as training and reference materials within Owner's organization.
  - a. This requirement is:
    - 1) Applicable to both paper copy and electronic files.
    - 2) Applicable to materials containing copyright notice as well as those with no copyright notice.
5. Notify supplier and/or manufacturer of the intended use of Operations and Maintenance Manuals provided under the Contract.

### B. Operation and Maintenance Manual Format and Delivery:

1. Draft electronic submittals:
  - a. Provide manual in Adobe Acrobat Portable Document Format (PDF), latest version.
  - b. Create one (1) PDF file for each equipment Operation and Maintenance Manual.
  - c. Do not password protect or lock the PDF document.
  - d. Drawings or other graphics must be converted to PDF file format from the original drawing file format and made part of the PDF document.
  - e. Scanning of drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 dpi or greater.
  - f. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
  - g. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual cover, the Table of Contents and each major section of the Table of Contents.
  - h. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
    - 1) Select File → Properties → Initial View.
    - 2) Select the Navigation tab: Bookmarks Panel and Page.
    - 3) Select the Page layout: Single Page.
    - 4) Select the Magnification: Fit Page.
    - 5) Select Open to page: 1.
    - 6) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.
  - i. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
    - 1) To do this:
      - a) Select Edit → Preferences → Documents → Save Settings.
      - b) Check the Save As optimizes for Fast Web View box.
  - j. PDF file naming convention:
    - 1) Use the Specification Section number, the manufacturer's name and the equipment description, separated by underscores.
    - 2) Do not put spaces in the file name.
2. Final electronic submittals:
  - a. Submit two (2) copies in PDF file format on two (2) CD-ROM discs (one (1) copy per CD-ROM), each secured in a jewel case.
  - b. CD-ROM Labeling:
    - 1) Provide the following printed labeling on all CD-ROM discs:
      - a) Project name.
      - b) Specification Section.
      - c) Equipment names and summary of tag(s) covered.

- d) Manufacturer name.
- e) Date (month, year).
- c. CD-ROM Jewel Case Holder:
  - 1) Insert jewel cases containing labeled CD-ROM discs in three-ring binder holder (C-Line Products, [www.c-lineproducts.com](http://www.c-lineproducts.com) stock number CLI-61968 or equivalent) at the front of each final paper copy.
3. Final paper copy submittals:
  - a. Quantity: Provide two (2) copies.
  - b. Paper: 8.5 x 11 IN or 11 x 17 IN bright white, 20 pound paper with standard three-hole punching.
  - c. 3-Ring Binder:
    - 1) Provide D-ring binder with clear vinyl sleeves (i.e. view binder) on front and spine.
    - 2) Insert binder title sheet with the following information under the front and spine sleeves:
      - a) Project name.
      - b) Specification Section.
      - c) Equipment names and summary of tag(s) covered.
      - d) Manufacturer name.
      - e) Date (month, year).
    - 3) Provide plastic sheet lifters prior to first page and following last page.
  - d. Drawings:
    - 1) Provide all drawings at 11 x 17 IN size, triple folded and three-hole punched for insertion into manual.
    - 2) Where reduction is not practical to ensure readability, fold larger drawings separately and place in three-hole punched vinyl envelopes inserted into the binder.
    - 3) Identify vinyl envelopes with drawing numbers.
  - e. Use plastic coated dividers to tab each section of each manual in accordance with the Table of Contents.
- C. Equipment Operation and Maintenance Manual Content:
  1. Provide a cover page as the first page of each manual with the following information:
    - a. Manufacturer(s) Name and Contact Information.
    - b. Vendor's Name and Contact Information.
    - c. Date (month, year).
    - d. Project Owner and Project Name.
    - e. Specification Section.
    - f. Project Equipment Tag Numbers.
    - g. Model Numbers.
    - h. Engineer's Name.
    - i. Contractor's Name.
  2. Provide a Table of Contents for each manual.
  3. Provide Equipment Record sheets as follows:
    - a. Printed copies of the Equipment Record (Exhibits B1, B2 and B3), as the first tab following the Table of Contents.
    - b. Exhibits B1-B3 are available as Fillable PDF Form documents from the Engineer.
    - c. Each section of the Equipment Record must be completed in detail; simply referencing the related equipment Operation and Maintenance Manual sections for nameplate, maintenance, spare parts or lubricant information is not acceptable.
    - d. For equipment involving separate components (for example, a motor and gearbox), a fully completed Equipment Record is required for each component.
    - e. Submittals that do not include the Equipment Record(s) will be rejected without further content review.
  4. Provide a printed copy of the Manufacturer's Field Services report as required by Specification Section 01 75 00 following the Equipment Record sheets.
  5. Provide the following detailed information, as applicable:

- 1 a. Use equipment tag numbers from the Contract Documents to identify equipment and
- 2 system components.
- 3 b. Equipment function, normal and limiting operating characteristics.
- 4 c. Instructions for assembly, disassembly, installation, alignment, adjustment, and
- 5 inspection.
- 6 d. Operating instructions for start-up, normal operation, control, shutdown, and
- 7 emergency conditions.
- 8 e. Lubrication and maintenance instructions.
- 9 f. Troubleshooting guide.
- 10 g. Mark each sheet to clearly identify specific products and component parts and data
- 11 applicable to the installation for the Project; delete or cross out information that does
- 12 not specifically apply to the Project.
- 13 h. Parts lists:
- 14 1) A parts list and identification number of each component part of the equipment.
- 15 2) Exploded view or plan and section views of the equipment with a detailed parts
- 16 callout matching the parts list.
- 17 3) A list of recommended spare parts.
- 18 4) List of spare parts provided as specified in the associated Specification Section.
- 19 5) A list of any special storage precautions which may be required for all spare parts.
- 20 i. General arrangement, cross-section, and assembly drawings.
- 21 j. Electrical diagrams, including elementary diagrams, wiring diagrams, connection
- 22 diagrams, and interconnection diagrams.
- 23 k. Test data and performance curves.
- 24 l. As-constructed fabrication or layout drawings and wiring diagrams.
- 25 m. Copy of the equipment manufacturer's warranty meeting the requirements of the
- 26 Contract.
- 27 n. Copy of any service contracts provided for the specific piece of equipment as part of
- 28 the Contract.
- 29 6. Additional information as required in the associated equipment or system Specification
- 30 Section.

31 **D. Building Materials and Finishes Operation and Maintenance Manual Content:**

- 32 1. Building products, applied materials and finishes:
- 33 a. Include product data, with catalog number, size, composition and color and texture
- 34 designations.
- 35 b. Provide information for ordering custom manufactured products.
- 36 2. Necessary precautions:
- 37 a. Include product MSDS for each approved product.
- 38 b. Include any precautionary application and storage guidelines.
- 39 3. Instructions for care and maintenance:
- 40 a. Include manufacturer's recommendations for cleaning agents and methods, precautions
- 41 against detrimental agents and methods and recommended schedule for cleaning and
- 42 maintenance.
- 43 4. Moisture protection and weather exposed products:
- 44 a. Include product data listing, applicable reference standards, chemical composition, and
- 45 details of installation.
- 46 b. Provide recommendations for inspections, maintenance and repair.
- 47 5. Additional requirements as specified in individual product specifications.

48 **1.6 TRANSMITTAL OF SUBMITTALS**

49 **A. Operation and Maintenance Manuals.**

- 50 1. Transmit all submittals to:
- 51 a. The address specified in Specification Section 01 33 00 - SUBMITTALS.
- 52
- 53 2. Transmittal form: Use Operation and Maintenance Manual Transmittal, Exhibit A.
- 54 3. Transmittal numbering:

- 1 a. Number each submittal with the Specification Section number followed by a series
- 2 number beginning with "-01" and increasing sequentially with each additional
- 3 transmittal, followed by "-OM" (for example: 11061-01-OM).
- 4 4. Submit draft and final Operation and Maintenance Manual in electronic format (PDF) to
- 5 Engineer, until manual is approved.
- 6 B. Expedited Return Delivery:
- 7 1. Include prepaid express envelope or air bill in submittal transmittal package for any
- 8 submittals Contractor expects or requires express return mail.
- 9 2. Inclusion of prepaid express envelope or air bill does not obligate Engineer to conduct
- 10 expedited review of submittal.
- 11 **1.7 ENGINEER'S REVIEW ACTION**
- 12 A. Draft Electronic (PDF) Submittals:
- 13 1. Engineer will review and indicate one of the following review actions:
- 14 a. A - ACCEPTABLE
- 15 b. B - FURNISH AS NOTED
- 16 c. C - REVISE AND RESUBMIT
- 17 d. D - REJECTED
- 18 2. Submittals marked as Acceptable or Furnish As Noted will be retained; however, the
- 19 transmittal form will be returned with a request for the final paper and electronic documents
- 20 to be submitted.
- 21 3. Copies of submittals marked as Revise and Resubmit or Rejected will be returned with the
- 22 transmittal form marked to indicate deficient areas.
- 23 4. Resubmit until approved.
- 24 B. Final Paper Copy Submittals:
- 25 1. Engineer will review and indicate one (1) of the following review actions:
- 26 a. A - ACCEPTABLE
- 27 b. D - REJECTED
- 28 2. Submittals marked as Acceptable will be retained with the transmittal form returned as
- 29 noted.
- 30 3. Submittals marked as Rejected will be returned with the transmittal form marked to indicate
- 31 deficient areas.
- 32 4. Resubmit until approved.

**PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**END OF SECTION**





EXHIBIT A **Operation and Maintenance Manual**  
**Transmittal** \_\_\_\_\_ - \_\_\_\_\_ - OM  
(Spec Section) (Series)

Project Name:		Date Received:
Project Owner:		Checked By:
Contractor:	Owner:	Log Page:
Address:	Address:	HDR No.:
Attn:	Attn:	1st. Sub. ReSub.

Date Transmitted:	Previous Transmittal Date:
-------------------	----------------------------

No. Copies	Description of Item	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

To:	From:
	<i>HDR Engineering, Inc.</i>
	Date:

\* The Action designated above is in accordance with the following legend:

- A - Acceptable
- B - Furnish as Noted
- C - Revise and Resubmit
- D - Rejected

Comments:

Distribution:		Contractor		File		Field		Owner		Other	

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## EXHIBIT B1

## Equipment Record

## Equipment Data and Spare Parts Summary

Project Name			Specification Section:		
Equipment Name			Year Installed:		
Project Equipment Tag No(s).					
Equipment Manufacturer			Project/Order No.		
Address			Phone		
Fax		Web Site		E-mail	
Local Vendor/Service Center					
Address			Phone		
Fax		Web Site		E-mail	

## MECHANICAL NAMEPLATE DATA

Equip.			Serial No.		
Make			Model No.		
ID No.	Frame No.	HP	RPM	Cap.	
Size	TDH	Imp. Sz.	CFM	PSI	
Other:					

## ELECTRICAL NAMEPLATE DATA

Equip.			Serial No.					
Make			Model No.					
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

## SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

## RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

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## EXHIBIT B2

## Equipment Record

## Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).							
<b>RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)</b>	<b>INITIAL COMPLETION * FOLLOWING START-UP</b>							
	D	W	M	Q	S	A	RT	Hours
<b>RECOMMENDED PREVENTIVE MAINTENANCE</b>	<b>PM TASK INTERVAL *</b>							
	D	W	M	Q	S	A	RT	Hours
<b>* D = Daily    W = Weekly    M = Monthly    Q = Quarterly    S = Semiannual    A = Annual    Hours = Run Time I</b>								
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**EXHIBIT B3****Equipment Record****Lubrication Summary**

Equipment Description	Project Equip. Tag No(s).
-----------------------	---------------------------

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

(Feb 1991; Revised Oct 2001, Revised Nov 2007)  
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**SECTION 01 35 05**  
**ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste materials, and protection of deposits of historical or archaeological interest.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

**1.2 SUBMITTALS**

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Prior to the start of any construction activities submit:
  - a. A detailed proposal of all methods of control and preventive measures to be utilized for environmental protection.
  - b. A drawing of the work area, haul routes, storage areas, access routes and current land conditions including trees and vegetation.
  - c. A copy of the NPDES permit for storm water discharges from construction activities.
  - d. A copy of the approved pollution prevention plan.

**PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations.

B. Land Protection:

1. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction shall be preserved in their present condition.
  - a. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.
2. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.
3. Restore all disturbed areas including borrow and haul areas and establish permanent type of locally adaptable vegetative cover.
4. Unless earthwork is immediately paved or surfaced, protect all side slopes and backslopes immediately upon completion of final grading.
5. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.

- 1                   6. Except for areas designated by the Contract Documents to be cleared and grubbed, the  
2 Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or  
3 disturb them without approval of the Engineer.  
4                   a. Any damage caused by the Contractor's equipment or operations shall be restored as  
5 nearly as possible to its original condition at the Contractor's expense.
- 6           C. Surface Water Protection:
- 7           1. Utilize, as necessary, erosion control methods to protect side and backslopes, minimize and  
8 the discharge of sediment to the surface water leaving the construction site as soon as rough  
9 grading is complete.  
10           a. These controls shall be maintained until the site is ready for final grading and  
11 landscaping or until they are no longer warranted and concurrence is received from the  
12 Engineer.  
13           b. Physically retard the rate and volume of run-on and runoff by:  
14               1) Implementing structural practices such as diversion swales, terraces, straw bales,  
15 silt fences, berms, storm drain inlet protection, rock outlet protection, sediment  
16 traps and temporary basins.  
17               2) Implementing vegetative practices such as temporary seeding, permanent seeding,  
18 mulching, sod stabilization, vegetative buffers, hydroseeding, anchored erosion  
19 control blankets, sodding, vegetated swales or a combination of these methods.  
20               3) Providing Construction sites with graveled or rock access entrance and exit  
21 drives and parking areas to reduce the tracking of sediment onto public or private  
22 roads.  
23           2. Discharges from the construction site shall not contain pollutants at concentrations that  
24 produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving  
25 stream or waterway.
- 26           D. Solid Waste Disposal:
- 27           1. Collect solid waste on a daily basis.  
28           2. Provide disposal of degradable solid waste to an approved solid waste disposal site.  
29           3. Provide disposal of nondegradable solid waste to an approved solid waste disposal site or in  
30 an alternate manner approved by Engineer and regulatory agencies.  
31           4. No building materials wastes or unused building materials shall be buried, dumped, or  
32 disposed of on the site.
- 33           E. Fuel and Chemical Handling:
- 34           1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.  
35           2. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides  
36 from entering drainage ways.  
37           3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other  
38 waste waters to enter a drainage way(s) or stream.  
39           4. The Contractor shall provide containment around fueling and chemical storage areas to  
40 ensure that spills in these areas do not reach waters of the state.
- 41           F. Control of Dust:
- 42           1. The control of dust shall mean that no construction activity shall take place without  
43 applying all such reasonable measures as may be required to prevent particulate matter from  
44 becoming airborne so that it remains visible beyond the limits of construction.  
45           a. Reasonable measures may include paving, frequent road cleaning, planting vegetative  
46 groundcover, application of water or application of chemical dust suppressants.  
47           b. The use of chemical agents such as calcium chloride must be approved by the State of  
48 New Mexico DOT.  
49           2. Utilize methods and practices of construction to eliminate dust in full observance of agency  
50 regulations.  
51           3. The Engineer will determine the effectiveness of the dust control program and may request  
52 the Contractor to provide additional measures, at no additional cost to Owner.

- 1 G. Burning:
- 2 1. Do not burn material on the site.
- 3 2. If the Contractor elects to dispose of waste materials by burning, make arrangements for an
- 4 off-site burning area and conform to all agency regulations.
- 5 H. Control of Noise:
- 6 1. Control noise by fitting equipment with appropriate mufflers.
- 7 I. Completion of Work:
- 8 1. Upon completion of work, leave area in a clean, natural looking condition.
- 9 2. Ensure all signs of temporary construction and activities incidental to construction of
- 10 required permanent work are removed.
- 11 J. Historical Protection:
- 12 1. If during the course of construction, evidence of deposits of historical or archaeological
- 13 interests is found, cease work affecting find and notify Engineer.
- 14 a. Do not disturb deposits until written notice from Engineer is given to proceed.
- 15 2. The Contractor will be compensated for lost time or changes in construction to avoid the
- 16 find based upon normal change order procedures.

17 **END OF SECTION**



1  
2  
3  
4  
5

## SECTION 01 42 13 STANDARD ABBREVIATIONS AND SYMBOLS

### PART 1 - GENERAL

#### 1.1 UNITS OF MEASUREMENT

A (amp)	ampere(s)
ACFM	actual CFM
AIC	amps interrupting capacity
AWG	American Wire Gage
BF	board foot (feet)
BHP	brake horsepower
BTU	British thermal unit
BTUH	British thermal units per hour
C	centigrade
cc	cubic centimeter
CCM/SEC	cubic centimeter(s) per second
CF	cubic feet
CFH	cubic feet per hour
CFM	cubic feet per minute
CM	centimeter(s)
CM/SEC	centimeter(s) per second
CPS	cycle(s) per second
CU	cubic
CU FT	cubic feet
CU IN	cubic inch(es)
CU M	cubic meter(s)
CY	cubic yard(s)
Db	decibel(s)
DbmV	decibel millivolts
DEG	degree(s) (angular)
DegC	degree(s) Centigrade
DegF	degree(s) Fahrenheit
F	Fahrenheit
FBM	board measure
FPM	feet per minute
FPS	feet per second
FT	feet, foot
FV	face velocity
G	gram(s)
GA	gage
GAL	gallon(s)
GAL/SF	gallon(s) per square foot
GPH	gallon(s) per hour
GPM	gallon(s) per minute
GPS	gallon(s) per second
HD	head
HP	horsepower
HR	hour(s)
Hz	hertz
IN	inch(es)
IN Hg	inches, mercury

IN-LB	inch-pounds (force)
IN WG	inches, water gage
IPS	iron pipe size
K	kip(s)
K value	thermal conductivity (BTU/IN/HR/SF/DegF)
KG	kilogram(s)
KHz	kilohertz
Kpa	kilopascal(s)
KSM	kilogram(s) per square meter
KV	kilovolt(s)
KVA	kilovolt ampere(s)
KVAR	kilovars
KW	kilowatt(s)
KWH	kilowatthours
L	liter(s)
LB	pound(s)
LBF-IN	pound (force) inch
LF	linear foot, linear feet
LIN	linear, lineal
LM	linear meter(s)
L/M	liter(s)/meter
M	meter
mA	milliamps
MBTU	thousand BTU
MBH	thousand BTU/HR
MCFH	thousand cubic feet per hour
MCM	thousand circular mils
MFBM	thousand feet board measure
MHz	megahertz
mHz	millihertz
MI	mile(s)
MIN. min.	minute(s), minimum
ml	milliliter
MM, mm	millimeter(s)
MO	month(s)
MPH	miles per hour
MVA	megavoltamperes
OZ	ounce(s)
QT	quart
RH	relative humidity
R value	thermal resistance ((SF x DegF x HR)/BTU)
RMS	root mean square
RPM	revolutions per minute
S	second
SCFM	standard CFM
SF	square foot, square feet
SM	square meter(s)
SQ CM	square centimeter(s)
SQ IN	square inch(es)
SQUARE	square (roofing) = 100 SF of surface
SSU	saybolt seconds universal
SYM	symmetrical
U value	thermal conductance (1 divided by total R value) (BTU/SF/DegF/HR)
uV	microvolts
V	volt(s)
Vac	volt(s), AC

Vdc	volt(s), DC
W	watt(s)
YD	yard(s)
YR	year(s)

## 1 1.2 TERMINOLOGY

A	astragal
@	at
AB	anchor bolt
A/C	air-condition, air-conditioner
AC	air compressor, alternating current
ACLD	air-cooled
ACOUS	acoustical
ACSR	aluminum conduit or steel reinforced
AD	area drain, automatic damper
ADH	adhesive
ADJ	adjust, adjustable
ADMIN	administration
A/E	Architect/Engineer
AFF	above finished floor
AFG	above finished grade
AGGR	aggregate
AHU	air handling unit
AL	aluminum
ALT	alternate
AM	amplitude modulation, ammeter
AMB	ambient
AMP	amplifier
ANOD	anodized
ANN	annunciator
ANT	antenna
AP	access panel
APC	acoustical plaster ceiling
APPAR	apparatus
APPX	appendix
APX	approximate
ART	article
ASPH	asphalt
ASST	assistant
ASSY	assembly
ATC	acoustical tile ceiling
ATS	automatic transfer switch
AUTO	automatic
AUX	auxiliary
AV	avenue
AVG	average
AWG	American Wire Gage
B	base, boiler, blank, bottom
BB	base board
B to B	back to back
BAL	balance
BAR	barrier
BAT	batten
BC	bottom of caisson

BCCMP	bituminous coated corrugated metal pipe
BD	board
BITUM	bituminous
BKR	breaker
BKT	bracket
BL	base line
BLDG	building
BLKG	blocking
BM	beam
BP	base plate
BR	bedroom
BRG	bearing
BRZ	bronze
BS	barium sink
BSMT	basement
BT	bathtub
BUR	built-up roof
BW	both ways
C to C	center to center
CA	cold air
CAB	cabinet
CATV	community antenna television
CB	chalk board
CC	cooling coil
CCB	concrete block, masonry
CCF	concrete floor
CCT	cubical curtain track
CCTV	closed circuit television
CD	ceiling diffuser
CEM	cement
CEM AB	cement asbestos board
CEM ASB	cement asbestos
CG	corner guard
CGU	ceramic glazed units
CH	chiller
CHAM	chamfer
CHW	chilled water
CI	cast iron
CIP	cast iron pipe, cast in place
CIR	circle
CJ	construction joint
CKT	circuit
CL	center line, clearance
CLG	ceiling
CLJ	control joint
CLKG	calking
CLO	closet
CM	Construction Manager
CMP	corrugated metal pipe
CMPR	compressor
CMT	ceramic mosaic tile
CND, C	conduit
CO	cleanout

COL	column
COM	common
COMP	composite
COMPR	compressible
CONC	concrete
COND	condition
CONN	connection
CONST	construction
CONT	continuous
CONTR	contractor
CU, COP	copper
ORR	corridor
CPT	carpet
CR	control room
CRIT	critical
CRT	cathode ray tube
CSMT	casement
CSS	clinical service sink
CT	ceramic tile, cooling tower
CTB	ceramic mosaic tile base
CTD	coated
CTR	center
CUH	cabinet unit heater
CULV	culvert
CURT	curtain
CW	cold water
d	delta
DA	deformed anchor
DBL	double
DBT	dry bulb temperature
DEM	demolition, demolish
DEPT	department
DET	detail
DF	drinking fountain
DIA, D	diameter
DIAG	diagonal
DIM	dimension
DISP	dispenser
DIST	distribution
DL	dead load
DN	down
DP	dampproofing, double pole, data processing
DR	drain, doctor's register
DT	dew point temperature
DWG	drawing
DWR	drawer
FA	fire alarm
FCAN	full capacity above nominal
FCBN	full capacity below nominal
FD	floor drain, fire damper
FDN	foundation
FDV	fire department valve
FE	fire extinguisher

FEC	fire extinguisher cabinet
FEM	female
FF	final filter
FH	fire hose
FHC	fire hose cabinet
FHV	fire hose valve
FL	floor, flush
FLA	full load amps
FLEX	flexible
FLG	flooring
FLUOR	fluorescent
FM	frequency modulation radio
FT	fin tube
FTG	footing
FURN	furnish
FUT	future
FV	field verify
FVC	fire valve cabinet
FWC	fabric wall covering
FXTR	fixture
GA	gage
GALV	galvanize(d)
G.C.	glazed coating
GEN	generator
G.F.	granular fill
GL	glass
GR	grade
GRD	ground
GSB	gypsum sheathing board
GWB	gypsum wallboard
GYP	gypsum
HB	hose bib
HC	handicapped
HDWD	hardwood
HID	high intensity discharge
H.M.	hollow metal
HORIZ	horizontal
HPS	high pressure sodium
HR	handrail
HTR	heater
HW	hardware, hot water
HX	heat exchanger
HZ	hertz
IC	intercom
ID	inside diameter
IH	intake head
IMC	intermediate metal conduit
INSL	insulation
ITB	interior top bar
IVT	intravenous track
JC	Janitor's closet
KO	knockout
LD	linear diffuser

LE	left end
LED	light emitting diode
LIN	linear, lineal
LL	liveload
LR	linear return
LRA	locked rotor amps
LS	life safety/support
LW	lightweight
M	meter
MACH	machine
MAS	masonry
MATL	material
MATV	master antenna television
MAX	maximum
MB	main breaker
MCB	metal corner bead
MCC	motor control center
MCP	motor circuit protector
MECH	mechanical
MED	medicine
MERC	mercury
MFD	manufactured
MFG	manufacturing
MFR	manufacturer
MGA	medical gas alarm
MH	manhole, metal hallide
MIN	minimum
MISC	miscellaneous
MLDG	molding
MLO	main lugs only
MO	masonry opening
MOD	modification, modify
MS	mop sink
MTD	mounted
MTG	mounting
MTL	material
MULL	mullion
MVA	mega-voltamperes
MWP	metal wall panel
N	North
NAT	natural
NATL	national
NC	nurse call, normally closed
NEG	negative
NIC	not in contract
NO	number, normally open
NOM	nominal
NORM	normal
NOS	nitrous oxide
NRC	noise reduction coefficient
NTS	not to scale
OA	outside air
OC	on center, overcurrent

OD	outside diameter
OPNG	opening
OPP	opposite
OX	oxygen
pH	chemical symbol for measure of acidity/alkalinity
QT	quarry tile
QTB	quarry tile base
QUAL	quality
R	radius
RA	return air
RAD	radiology
RCCP	reinforced concrete culvert pipe
RCP	reinforced concrete pipe
RCPT	receptacle
RCV	receive
RD	roof drain
road	
RE	right end
REC	recess
REF	refer
reference	
REFR	refrigerator
REIN	reinforce
REL A	relief air
REM	remainder
REQD	required
RESIL	resilient
REV	revise
revision	reversing
RF	return fan
RFG	roofing
RF(I)	radio frequency (interference)
RGS	rigid galvanized steel conduit
RH	relief hood
RM	room
RO	rough opening
RR	railroad
RTV	room temperature vulcanized (silicone fireproofing foam)
RV	reduced voltage
RVT	reinforced vinyl tile
R/W	right-of-way
RW	return wall register
RY	railway
S	sink
South	single
S2S	surfaces or dressed
2 sides	
S4S	surfaced or dressed
four sides	
SA	shock absorber
supply air	sound attenuator
SALV	salvage
SAN	sanitary

SAT	sound attenuator
SB	sitz bath
SC	sill cock
SCH	schedule
SCR	silicone controlled rectifier
SD	shower drain
smoke damper	shower door
SECT	section
SECY	secretary
SF	supply fan
SFD	smoke-actuated fire damper
SGL	single
SH	shower
SIM	similar
SL	sliding
SLV	sleeve
S/N	solid neutral
SP	standpipe
sump pump	static pressure
SPD	standpipe drain
SPEC	specification
SQ	square
SR	sheet rubber
SRV	steam safety relief valve
SS	service sink
SSS	surgeons' scrub sink
SST	stainless steel
ST	stainless steel sink
steam trap	street
STA	station
stationary	
START	starter
STD	standard
STIFF	stiffener
STOR	storage
STRL	structural
SURF	surface
SUSP	suspend(ed)
SV	sheet vinyl
SV(N.S.)	sheet vinyl (nonslip)
SW	supply wall diffuser
switch	
SWBD	switchboard
SYM	symbol
symmetrical	
SYS	system
T	toilet
throw	top
T & G	tongue and groove
TA	tempered air
TB	tackboard
TC	top of curb
TEL	telephone

TEMP	temperature
temporary	
TER	terrazzo
TERM	terminal
THRU	through
TOC	top of caisson
TOF	top of footing
TOW	top of wall
TP	toilet partition
TRT	treat
treatment	treated
TS	top of steel
TV	television
TX	transformer
TYP	typical
UC	undercut
UH	unit heater
UHF	ultra high frequency
UNEX	unexcavated
UNFIN	unfinished
UR	urinal
US	utility sink
UTIL	utility
VAC	vacuum
VAV	variable air volume
VB	vapor barrier
VCP	vittrified clay pipe
VCPX	vittrified clay pipe
extra strength	
VD	volume damper
VEH	vehicle
VERT	vertical
VEST	vestibule
VF	ventilation fan drop
VHF	very high frequency
VM	voltmeter
VOL	volume
VP	vacuum pump
VS	venturi station
VT	vinyl tile
VTR	vent thru roof
VWC	vinyl wall covering
W	West
wide flange	wall mounted
W/	with
WA	Wainscot
WBT	wet bulb temperature
WC	water closet
WD	wood
WDW	window
WF	wide flange
WH	water heater
WI	wrought iron

WL	wind load
WLD	welded
WM	wattmeter
W/O	without
WP	waterproof(ing)
weatherproof (electrical)	working point
WS	waterstop
WT	weight
WWC	wood wall covering
WWR	welded wire reinforcement
XFMR	transformer
XP	explosion proof
YD	yard
YR	year
Y W	wye
XLP	cross linked polyethylene
ZA	zone annunciator
1S	single speed
2S	two speed
1W	one winding
2W	two winding

1

## 2 1.3 ORGANIZATIONS AND STANDARDS

3	ANSI	American National Standards Institute
4	ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.
5	ASME	American Society of Mechanical Engineers
6	ASTM	ASTM International
7	CS	Commercial Standard (U.S.Department of Comm.)
8	FM	FM Global
9	FS	Federal Specification
10	IEEE	Institute of Electrical and Electronic Engineers
11	IES	Illuminating Engineering Society
12	IPCEA	Insulated Power Cable Engineers Association
13	NBS	National Bureau of Standards
14	NEC	National Electrical Code
15	NECA	National Electrical Contractors Association
16	NECS	National Electrical Code Standards
17	NEMA	National Electrical Manufacturers Association
18	NFPA	National Fire Protection Association
19	SMACNA	Sheet Metal and Air Conditioning National Contractors Association, Inc.
20	UL	Underwriters Laboratories, Inc.

21

## END OF SECTION



**SECTION 01 61 05**  
**MAJOR EQUIPMENT SUPPLIERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. A listing of the equipment for the Project, which is considered to be major equipment.
  2. A listing of the approved suppliers of said major equipment.
  3. Certain instructions concerning the bidding of major equipment.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.

**1.2 DEFINITIONS**

- A. Manufacturers or suppliers, as used in the context of "approved manufacturers or suppliers of major equipment," shall mean the manufacturers or suppliers listed in the ACCEPTABLE MANUFACTURERS OF MAJOR EQUIPMENT Article of this Specification Section.

**1.3 INSTRUCTIONS FOR BIDDING MAJOR EQUIPMENT**

- A. Furnish, for base bid, equipment by any of the suppliers listed in the ACCEPTABLE MANUFACTURERS OF MAJOR EQUIPMENT Article of this Specification Section, or as added to the ACCEPTABLE MANUFACTURERS OF MAJOR EQUIPMENT Article of this Specification Section by addendum.
- B. Name only one (1) of said suppliers in the schedule of major equipment suppliers found in the Proposal.
- C. Proposal shall be considered irregular and subject to rejection if the Bidder:
1. Fails to list an approved supplier for each item.
  2. Lists more than one approved supplier for each item.
- D. If the Bidder fails to list an approved supplier, the Owner has the sole right to select one (1) of the suppliers from the list of manufacturers in the ACCEPTABLE MANUFACTURERS OF MAJOR EQUIPMENT Article of this Specification Section.
- E. If the Bidder lists more than one (1) approved supplier, the Owner has the sole right to select one (1) of the suppliers so listed.
- F. Requests for prequalification of equipment to be listed in the ACCEPTABLE MANUFACTURERS OF MAJOR EQUIPMENT Article of this Specification Section must comply specifically with applicable provisions of the Contract Documents.
1. Refer to Specification Section 00 21 13.

**1.4 ACCEPTABLE MANUFACTURERS OF MAJOR EQUIPMENT**

- A. Major Equipment and Acceptable Manufacturers listed below must comply with technical specifications. Technical specifications take precedence over the manufacturer's standard's. Only the manufacturers listed are approved for this project, no alternate manufacturers will be considered.
1. Pumping Equipment: Submersible Non-Clog (Section 43 21 21)
    - a. Flygt

**END OF SECTION**



**SECTION 01 65 50**  
**PRODUCT DELIVERY, STORAGE, AND HANDLING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Scheduling of product delivery.
  - 2. Packaging of products for delivery.
  - 3. Protection of products against damage from:
    - a. Handling.
    - b. Exposure to elements or harsh environments.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
- C. Payment:
  - 1. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved Shop Drawings.
    - a. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

**1.2 DELIVERY**

- A. Scheduling: Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.
- B. Packaging: Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.
- C. Identification: Clearly and fully mark and identify as to manufacturer, item, and installation location.
- D. Protection and Handling: Provide manufacturer's instructions for storage and handling.

**PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**PART 3 - EXECUTION**

**3.1 PROTECTION, STORAGE AND HANDLING**

- A. Manufacturer's Instruction:
  - 1. Protect all products or equipment in accordance with manufacturer's written directions.
    - a. Store products or equipment in location to avoid physical damage to items while in storage.
    - b. Handle products or equipment in accordance with manufacturer's recommendations and instructions.
  - 2. Protect equipment from exposure to elements and keep thoroughly dry.
  - 3. When space heaters are provided in equipment, connect and operate heaters during storage until equipment is placed in service.

1    **3.2   FIELD QUALITY CONTROL**

2       A.   Inspect Deliveries:

3           1.   Inspect all products or equipment delivered to the site prior to unloading.

4               a.   Reject all products or equipment that are damaged, used, or in any other way  
5                   unsatisfactory for use on Project.

6       B.   Monitor Storage Area: Monitor storage area to ensure suitable temperature and moisture  
7           conditions are maintained as required by manufacturer or as appropriate for particular items.

8                                   **END OF SECTION**

**SECTION 01 73 20**  
**OPENINGS AND PENETRATIONS IN CONSTRUCTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Methods of installing and sealing openings and penetrations in construction.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 09 91 00 - Painting and Protective Coatings.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Concrete Institute (ACI):
    - a. 318, Building Code Requirements for Structural Concrete.
  - 2. ASTM International (ASTM):
    - a. A36, Standard Specification for Carbon Structural Steel.
    - b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 3. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC):
      - 1) Article 501, Class I Locations.
    - b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
  - 4. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- B. Assure all firestopping materials are in full compliance with Specification Section 07 84 00.
- C. Obtain prior approval from Engineer when any opening larger than 100 SQ IN must be made in existing or newly completed construction.

**1.3 DEFINITIONS**

- A. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.
- B. Washdown Areas: Areas having floor drains or hose bibs.

**1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. For each structure provide dimensioned or scaled (minimum 1/8 IN = 1 FT) plan view drawings containing the following information:
    - a. Vertical and horizontal location of all required openings and penetrations.
    - b. Size of all openings and penetrations.
    - c. Opening type.
    - d. Seal type.
  - 3. Manufacturer's installation instructions for standard manufactured products.

## 1.5 PROJECT CONDITIONS

- A. For purposes of this Project, water table level is elevation unknown.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Pipe Sleeves: Steel, ASTM A53, Schedule 40, black.
- B. Pipe Sleeves Penetrating into Corrosive Areas: Stainless steel, 1/4 IN minimum thickness.
- C. Backing Rod and Sealant:
- D. Modular Mechanical Seals:
  - 1. Acceptable manufacturers:
    - a. Link-Seal.
  - 2. 316 stainless steel bolts, nuts and washers.
- E. Commercial Wall Castings:
  - 1. For unclassified areas both sides of penetration:
    - a. Ductile iron, class equal to connecting piping system.
  - 2. For wet/corrosive areas either side of penetration:
    - a. Stainless steel, 304L.

## PART 3 - EXECUTION

### 3.1 INSTALLATION AND APPLICATION

- A. Perform electrical penetrations in accordance with NFPA 70, Article 501.
- B. Install sleeves and castings in accordance with ACI 318, Chapter #6.
- C. Hot-dip galvanize in accordance with Specification Section 05 50 00 (or paint in accordance with Specification Section 09 91 00) all steel sleeves installed.
- D. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.
  - 1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.
- E. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.
  - 1. In non-washdown areas, install sleeves with ends flush with finished surfaces.
- F. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.
- G. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.
- H. Do not cut into or core drill any beams, joists, or columns.
- I. Do not install sleeves in beams, joists, or columns.
- J. Do not install recesses in beams, joists, columns, or slabs.
- K. Field Cutting and Coring:
  - 1. Saw or core drill with non-impact type equipment.

- 1           2. Mark opening and drill small 3/4 IN or less holes through structure following opening
- 2           outline.
- 3           3. Sawcut opening outline on both surfaces.
- 4           a. Knock out within sawcuts using impact type equipment.
- 5           b. Do not chip or spall face of surface to remain intact.
- 6           c. Do not allow any overcut with saw kerf.
- 7       L. Precast-Prestressed Concrete Construction:
- 8           1. Do not cut openings nor core drill vertically or horizontally through stems of members.
- 9           2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in
- 10          stems of members.
- 11          3. Cast openings and sleeves into flanges of units.
- 12          4. Cast openings larger than 6 IN in diameter or 6 IN maximum dimension in units at time of
- 13          manufacture.
- 14          5. Cast openings smaller than 6 IN in diameter or 6 IN maximum dimensions in flanges of
- 15          units at time of manufacture or field cut.
- 16       M. Where alterations are necessary or where new and old work join, restore adjacent surfaces to
- 17          their condition existing prior to start of work.
- 18       N. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in
- 19          concrete.
- 20           1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
- 21           2. For commercial castings, cast water stop/anchor with wall pipe.
- 22           3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
- 23           4. For fabricated units, diameter of plate or flange to be 4 IN larger than outside diameter of
- 24           sleeve, pipe or ductwork.
- 25           5. For commercial castings, waterstop/anchor size to be manufacturer standard.
- 26           6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.
- 27       O. Where area is blocked out to receive sheet metal sleeve at later date:
- 28           1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially
- 29           placed concrete and sleeve encasement concrete which is placed later.
- 30           a. Size blockout based on sleeve size required plus 4 to 6 IN each side of sleeve for
- 31           concrete encasement.
- 32           b. Provide #4 dowels at 12 IN spacing along each side of blockout with minimum of
- 33           two (2) dowels required per side.
- 34           2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all
- 35           sides of blockout.
- 36           a. Size blockout based on sleeve size required plus 2 to 4 IN each side of sleeve for
- 37           concrete encasement.
- 38       P. For interior wall applications where backer rod and sealant are specified, provide backer rod and
- 39          sealant at each side of wall.
- 40       Q. Refer to Drawings for location of fire-rated walls, floors, and ceilings.
- 41           1. Utilize firestopping materials and procedures specified in Specification Section 07 84 00 in
- 42           conjunction with scheduled opening type to produce the required fire rating.
- 43       R. Use full depth expanding foam sealant for seal applications where single or multiple pipes,
- 44          conduits, etc., pass through a single sleeve.
- 45       S. Do not make duct or conduit penetrations below high water levels when entering or leaving
- 46          tanks, wet wells, or other water holding structures.
- 47       T. Modular Mechanical Seals:
- 48           1. Utilize one (1) seal for concrete thickness less than 8 IN and two (2) seals for concrete, 8 IN
- 49           thick or greater.
- 50           2. Utilize two (2) seals for piping 16 IN diameter and larger if concrete thickness permits.

- 1                   3. Install seals such that bolt heads are located on the most accessible side of the penetration.
- 2           U. Backer Rod and Sealant:
- 3               1. Install in accordance with Specification Section 07 92 00.
- 4               2. Provide backer rod and sealant for modular mechanical seal applications.
- 5                   a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

6   **3.2 SCHEDULES**

- 7           A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation
- 8               Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
- 9               1. Provide the following opening and penetration types:
- 10                   a. Type A - Block out 2 IN larger than outside dimensions of duct, pipe, or conduits.
- 11                   b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet
- 12                       metal or pipe sleeve.
- 13                   c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe
- 14                       sleeve with water ring for wet and/or washdown areas.
- 15                   d. Type D - Commercial type casting or fabrication.
- 16                   e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe,
- 17                       duct or conduit spools.
- 18                   f. Type F - Integrally cast pipe, duct or conduit.
- 19                   g. Type G - Saw cut or line-drill and remove area 1 IN larger than outside dimensions of
- 20                       duct, pipe or conduit.
- 21                   h. Type H - Core drill.
- 22                   i. Type I - Block out area. At later date, place new concrete with integrally cast sheet
- 23                       metal or pipe sleeve.
- 24               2. Provide seals of material and method described as follows.
- 25                   a. Category 1 - Modular Mechanical Seal.
- 26                   b. Category 2 - Roof curb and flashing according to SMACNA specifications unless
- 27                       otherwise noted on Drawings. Refer to Specification Section 07 62 00 and roofing
- 28                       Specification Sections for additional requirements.
- 29                   c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing
- 30                       rod and sealant used in sleeve annulus.
- 31                   d. Category 4 - Backer rod and sealant.
- 32                   e. Category 5 - Full depth compressible sealant with escutcheons on both sides of
- 33                       opening.
- 34                   f. Category 6 - Full depth compressible sealant and flanges on both sides of opening.
- 35                       Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN
- 36                       larger than opening.
- 37                   g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding
- 38                       foam sealant depending on application.
- 39               3. Furnish openings and sealing materials through new floors, roofs, partitions and walls in
- 40                   accordance with Schedule A, Openings and Penetrations for New Construction.
- 41               4. Furnish openings and sealing materials through existing floors, roofs, partitions and walls in
- 42                   accordance with Schedule B, Openings and Penetrations for Existing Construction.
- 43

**SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE  
FOR NEW CONSTRUCTION**

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	C F I	7 Not Req 7	D F I <sup>(1)</sup>	Not Req Not Req 7	C F	7 Not Req
Through floors on grade above water table	C F I	4 Not Req 4	C F I <sup>(1)</sup>	7 Not Req 7	C F I <sup>(1)</sup>	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H <sup>(2)</sup> I <sup>(1)</sup>	4 3 4	F H <sup>(2)</sup> I <sup>(1)</sup>	Not Req 3 7
Through walls where one side is a hazardous area	C F I	7 Not Req 7	D F I <sup>(1)</sup>	Not Req Not Req 7	C F	7 Not Req
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I <sup>(1)</sup>	1 Not Req Not Req 1	F I <sup>(1)</sup>	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F I	7 Not Req 7	C D F H <sup>(2)</sup>	1 Not Req Not Req 1	C F H <sup>(2)</sup> I <sup>(1)</sup>	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req
Through exterior wall above grade	A B C	6 6 6	A B D H <sup>(2)</sup>	5 5 Not Req 5	C H <sup>(2)</sup>	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req

**SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE  
FOR EXISTING CONSTRUCTION**

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	B E	7 Not Req	B <sup>(1)</sup> E <sup>(3)</sup> H <sup>(2)</sup>	7 Not Req 7	B <sup>(1)</sup> E <sup>(3)</sup> H <sup>(2)</sup>	7 Not Req 7
Through floors on grade above water table	B	7	B	7	B	7
Through slab on grade below water table	E	Not Req	E	Not Req	E	Not Req
Through floors in washdown areas	G	3	G H <sup>(2)</sup>	3 3	G H <sup>(2)</sup>	3 3
Through walls where one side is a hazardous area	B E	7 Not Req	B <sup>(1)</sup> B <sup>(3)</sup> E H <sup>(2)</sup>	7 1 Not Req 7	B <sup>(1)(3)</sup> E H <sup>(2)</sup>	7 Not Req 7
Through exterior wall below grade above water table	B	7	B <sup>(1)</sup> B <sup>(3)</sup> H <sup>(2)</sup>	7 1 7	B <sup>(1)(3)</sup> H <sup>(2)</sup>	7 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	B E	7 Not Req	B E H <sup>(2)</sup>	1 Not Req 1	B <sup>(1)(3)</sup> E H <sup>(2)</sup>	7 Not Req 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	E	Not Req	E	Not Req	E	Not Req
Through exterior wall above grade	G	6	G <sup>(1)(3)</sup> H <sup>(2)</sup>	5 5	G <sup>(1)(3)</sup> H <sup>(2)</sup>	5 7
Roof penetrations	G	2	G <sup>(1)(3)</sup> H <sup>(2)</sup>	2	G	2
Through interior walls and slabs not covered by the above applications	G	4	G <sup>(1)(3)</sup> H <sup>(2)</sup>	4 4	G <sup>(1)(3)</sup> H <sup>(2)</sup>	4 4

<sup>(1)</sup> Multiple piping 3 IN and smaller or multiple conduits.

<sup>(2)</sup> Single pipe 3 IN and smaller or single conduit.

<sup>(3)</sup> Single pipe or conduit larger than 3 IN.

**END OF SECTION**

**SECTION 01 74 13**  
**CLEANING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Intermediate and final cleaning of Work not including special cleaning of closed systems specified elsewhere.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.

**1.2 STORAGE AND HANDLING**

- A. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

**1.3 SCHEDULING**

- A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Cleaning Agents:
  - 1. Compatible with surface being cleaned.
  - 2. New and uncontaminated.
  - 3. For Manufactured Surfaces: Material recommended by manufacturer.

**PART 3 - EXECUTION**

**3.1 CLEANING - GENERAL**

- A. Prevent accumulation of wastes that create hazardous conditions.
- B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.
- C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.
- D. Dispose of degradable debris at an approved solid waste disposal site.
- E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.
- F. Handle materials in a controlled manner with as few handlings as possible.
- G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions warrant greater care.
- H. On completion of work, leave area in a clean, natural looking condition.



**SECTION 01 75 00**  
**SYSTEM START-UP**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
  - 2. Requirements for Substantial Completion Submittals.
- B. Related Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 40 05 05 - Equipment: Basic Requirements.
  - 4. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.

**1.2 DEFINITIONS**

- A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.
- B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
  - 1. Finishing type construction work to ensure the each PCS has reached a state of Substantial Completion.
  - 2. Equipment start-up.
  - 3. Personnel training.
- C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the Project Classified System and starts up and operates the Project Classified System, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the Project Classified System as evidence of Substantial Completion.
- D. Substantial Completion: See the General Conditions.

**1.3 SUBMITTALS**

- A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- B. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.
  - 1. Master operation and maintenance training schedule:
    - a. Submit 14 days (minimum) prior to first training session for Owner's personnel.
    - b. Schedule to include:
      - 1) Target date and time for Owner witnessing of each system initial start-up.
      - 2) Target date and time for Operation and Maintenance training for each system, both field and classroom.
      - 3) Target date for initiation of Demonstration Period.
    - c. Submit for review and approval by Owner.
    - d. Include holidays observed by Owner.

- e. Attend a schedule planning and coordination meeting 21 calendar days prior to first anticipated training session.
  - 1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
  - 2) Identify initial target dates for individual manufacturer's training sessions.
- f. Owner reserves the right to insist on a minimum seven (7) days' notice of rescheduled training session not conducted on master schedule target date for any reason.
- g. Schedule to be resubmitted until approved.
- 2. Substantial Completion Submittal:
  - a. File Contractor's Notice of Substantial Completion and Request for Inspection.
  - b. Approved Operation and Maintenance manuals received by Engineer minimum one (1) week prior to scheduled training.
  - c. Written request for Owner to witness each system pre-demonstration start-up.
    - 1) Request to be received by Owner minimum 14 days before scheduled training of Owner's personnel on that system.
  - d. Equipment installation and pre-demonstration start-up certifications.
  - e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

#### **1.4 COST OF START-UP**

- A. Contractor to pay all costs associated with System start-up.

### **PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Facility Start-up Divided into Two Periods:
  - 1. Pre-Demonstration Period including:
    - a. Completion of construction work to bring Project to a state of Substantial Completion.
    - b. Start-up of Equipment.
    - c. Training of Personnel.
    - d. Completion of the filing of all required submittals.
    - e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.
  - 2. Demonstration Period including:
    - a. Demonstration of functional integrity of facility or PCS.

#### **3.2 PRE-DEMONSTRATION PERIOD**

- A. Completion of Construction Work:
  - 1. Complete the work to bring the PCS to a state of substantial completion.
- B. Equipment Start-up:
  - 1. Requirements for individual items of equipment are included in Division 02 through Division 46 Specification Sections.
  - 2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
  - 3. Perform Equipment Start-up to extent possible} without introducing product flow.
  - 4. Introduce product flow to complete Equipment Start-up for the following equipment:
    - a. New pumps
  - 5. Procedures include but are not necessarily limited to the following:
    - a. Test or check and correct deficiencies of:
      - 1) Power, control, and monitoring circuits for continuity prior to connection to power source.

- 2) Voltage of all circuits.
- 3) Phase sequence.
- 4) Cleanliness of connecting piping systems.
- 5) Alignment of connected machinery.
- 6) Vacuum and pressure of all closed systems.
- 7) Lubrication.
- 8) Valve orientation and position status for manual operating mode.
- 9) Tankage for integrity using product flow.
- 10) Pumping equipment using product flow.
- 11) Instrumentation and control signal generation, transmission, reception, and response.
  - a) See Specification Section 40 90 00.
- 12) Tagging and identification systems.
- 13) All equipment: Proper connections, alignment, calibration and adjustment.
- b. Calibrate all safety equipment.
- c. Manually rotate or move moving parts to assure freedom of movement.
- d. "Bump" start electric motors to verify proper rotation.
- e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.
- f. Documentation:
  - 1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Start-up.
  - 2) Provide a place for the Contractor to record date and person accomplishing required work.
  - 3) Submit completed document before requesting inspection for Substantial Completion certification.
6. Obtain certifications, without restrictions or qualifications, and deliver to Engineer:
  - a. Manufacturer's equipment installation check letters (sometimes referred to as Manufacturer's Field Services report).
  - b. Instrumentation Supplier's Instrumentation Installation Certificate.
- C. Personnel Training:
  1. See individual equipment specification sections.
  2. Conduct all personnel training after completion of Equipment Start-up for the equipment for which training is being conducted.
    - a. Personnel training on individual equipment or systems will not be considered completed unless:
      - 1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
      - 2) No system malfunctions occur during training.
      - 3) All provisions of field and classroom training specifications are met.
    - b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.
  3. Field and classroom training requirements:
    - a. Hold classroom training on-site.
    - b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions.
      - 1) Organize each training session in a format compatible with video recording.
    - c. Training instructor qualification: Factory trained and familiar with giving both classroom and "hands-on" instructions.
    - d. Training instructors:
      - 1) Be at classes on time.
      - 2) Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule.
      - 3) Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.

- 1 e. Organize training sessions into maintenance verses operation topics and identify on
- 2 schedule.
- 3 f. Plan for minimum class attendance of five (5) people at each session and provide
- 4 sufficient classroom materials, samples, and handouts for those in attendance.
- 5 g. Instructors to have a typed agenda and well prepared instructional material.
- 6 1) The use of visual aids, e.g., films, pictures, and slides is recommended for use
- 7 during the classroom training programs.
- 8 2) Deliver agendas to the Engineer a minimum of seven (7) days prior to the
- 9 classroom training.
- 10 3) Provide equipment required for presentation of films, slides, and other visual aids.
- 11 h. In the on-site training sessions, cover the information required in the Operation and
- 12 Maintenance Manuals submitted according to Specification Section 01 33 04 and the
- 13 following areas as applicable to PCS's.
- 14 1) Operation of equipment.
- 15 2) Lubrication of equipment.
- 16 3) Maintenance and repair of equipment.
- 17 4) Troubleshooting of equipment.
- 18 5) Preventive maintenance procedures.
- 19 6) Adjustments to equipment.
- 20 7) Inventory of spare parts.
- 21 8) Optimizing equipment performance.
- 22 9) Capabilities.
- 23 10) Operational safety.
- 24 11) Emergency situation response.
- 25 12) Takedown procedures (disassembly and assembly).
- 26 i. Address above Paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address
- 27 above Paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.
- 28 j. Maintain a log of classroom training provided including: Instructors, topics, dates,
- 29 time, and attendance.
- 30 D. Complete the filing of all required submittals:
- 31 1. Shop Drawings.
- 32 2. Operation and Maintenance Manuals.
- 33 3. Training material.
- 34 E. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project or
- 35 PCS:
- 36 1. File the notice when the following have been completed:
- 37 a. Construction work (brought to state of Substantial Completion).
- 38 b. Equipment Start-up.
- 39 c. Personnel Training.
- 40 d. Submittal of required documents.
- 41 2. Engineer will review required submittals for completeness within 10 calendar days of
- 42 Contractor's notice. If complete, Engineer will complete inspection of the Work, within 10
- 43 calendar days of Contractor's notice.
- 44 3. Engineer will inform Contractor in writing of the status of the Work reviewed, within 14
- 45 calendar days of Contractor's notice.
- 46 a. Work determined not meeting state of Substantial Completion:
- 47 1) Contractor: Correct deficiencies noted or submit plan of action for correction
- 48 within 5 days of Engineer's determination.
- 49 2) Engineer: Reinspect work within 5 days of Contractor's notice of correction of
- 50 deficiencies.
- 51 3) Reinspection costs incurred by Engineer will be billed to Owner who will deduct
- 52 them from final payment due Contractor.
- 53 b. Work determined to be in state of tentative Substantial Completion: Engineer to
- 54 prepare tentative "Engineer's Certificate of Substantial Completion."
- 55 c. Engineer's Certificate of Substantial Completion:

- 1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
  - 2) Issued for Project as a whole or for one or more PCS.
  - 3) Issued subject to completion or correction of items cited in the certificate (punch list).
  - 4) Issued with responsibilities of Owner and Contractor cited.
  - 5) Executed by Engineer.
  - 6) Accepted by Owner.
  - 7) Accepted by Contractor.
- d. Upon successful completion of Demonstration Period, Engineer will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

### 3.3 DEMONSTRATION PERIOD

#### A. General:

1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the PCS as evidence of Substantial Completion.
2. Duration of Demonstration Period: 72 consecutive hours.
3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed.
  - a. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure.
  - b. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
4. Conduct the demonstration of functional integrity under full operational conditions.
5. Owner will provide operational personnel to provide process decisions affecting plant performance.
  - a. Owner's assistance will be available only for process decisions.
  - b. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
7. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Demonstration Period.
8. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
  - a. Provide final field instruction on the following systems:
  - b. For the above systems, provide a total of 8 HRS instruction, divided among the systems as follows:
    - 1) Complete pump station system – 8 hrs
9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

**END OF SECTION**



**SECTION 03 09 00**  
**CONCRETE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Cast-in-place concrete and grout.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. American Concrete Institute (ACI):
    - a. 116R, Cement and Concrete Terminology.
    - b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
    - c. 212.3R, Chemical Admixtures for Concrete.
    - d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
    - e. 304.2R, Placing Concrete by Pumping Methods.
    - f. 305R, Hot Weather Concreting.
    - g. 306R, Cold Weather Concreting.
    - h. 318, Building Code Requirements for Structural Concrete.
    - i. 347, Guide to Formwork for Concrete.
  2. ASTM International (ASTM):
    - a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
    - b. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
    - c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
    - d. A1064, Standard Specification for Steel Wire and Welded Wire Replacement, Plain and Deformed, for Concrete.
    - e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
    - f. C33, Standard Specification for Concrete Aggregates.
    - g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
    - h. C94/C94M, Standard Specification for Ready-Mixed Concrete.
    - i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
    - j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
    - k. C150, Standard Specification for Portland Cement.
    - l. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
    - m. C172, Standard Practice for Sampling Freshly Mixed Concrete.
    - n. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
    - o. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
    - p. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
    - q. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

- r. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - s. C494, Standard Specification for Chemical Admixtures for Concrete.
  - t. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
  - u. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
  - v. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheet.
  - w. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
  - x. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
  - y. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
  - z. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - aa. E96, Standard Test Methods for Water Vapor Transmission of Materials.
  - bb. E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
  - cc. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
3. Corps of Engineers (COE):
    - a. CRD-C572, Specifications for Polyvinylchloride Waterstop.
    - b. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
  4. National Ready Mixed Concrete Association (NRMCA).
- B. Quality Control:
1. Concrete testing agency:
    - a. Contractor to employ and pay for services of a testing laboratory to:
      - 1) Perform materials evaluation.
      - 2) Design concrete mixes.
    - b. Concrete testing agency to meet requirements of ASTM E329.
  2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
    - a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
  3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
    - a. Do not use revised concrete mixes until submitted to and approved by Engineer.
  4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.
- C. Qualifications:
1. Ready mixed concrete batch plant certified by NRMCA.
  2. Formwork, shoring and reshoring for slabs and beams except where cast on ground to be designed by a professional engineer currently registered in the state where the Project is located.

### 1.3 DEFINITIONS

- A. Per ACI 116R except as modified herein:
1. Concrete fill: Non-structural concrete.
  2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
  3. Exposed concrete: Exposed to view after construction is complete.
  4. Indicated: Indicated by Contract Documents.

- 5. Lean concrete: Concrete with low cement content.
- 6. Nonexposed concrete: Not exposed to view after construction is complete.
- 7. Required: Required by Contract Documents.
- 8. Specified strength: Specified compressive strength at 28 days.
- 9. Submitted: Submitted to Engineer.

#### 1.4 SUBMITTALS

##### A. Shop Drawings:

- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- 2. Concrete mix designs proposed for use.
  - a. Concrete mix design submittal to include the following information:
    - 1) Sieve analysis and source of fine and coarse aggregates.
    - 2) Test for aggregate organic impurities.
    - 3) Test for deleterious aggregate per ASTM C289.
    - 4) Proportioning of all materials.
    - 5) Type of cement with mill certificate for cement.
    - 6) Type of fly ash with certificate of conformance to specification requirements.
    - 7) Slump.
    - 8) Air content.
    - 9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.
    - 10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
    - 11) Shrinkage test results.
    - 12) Standard deviation value for concrete production facility.
- 3. Product technical data including:
  - a. Acknowledgement that products submitted meet requirements of standards referenced.
  - b. Manufacturer's installation instructions.
  - c. Manufacturers and types:
    - 1) Joint fillers.
    - 2) Curing agents.
    - 3) Chemical sealer.
    - 4) Bonding and patching mortar.
    - 5) Construction joint bonding adhesive.
    - 6) Nonshrink grout with cure/seal compound.
    - 7) Waterstops.
- 4. Reinforcing steel:
  - a. Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
  - b. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
  - c. Obtain approval of Shop Drawings by Engineer before fabrication.
  - d. Mill certificates.
- 5. Strength test results of in place concrete including slump, air content and concrete temperature.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### A. Storage of Material:

- 1. Cement and fly ash:
  - a. Store in moistureproof, weathertight enclosures.
  - b. Do not use if caked or lumpy.
- 2. Aggregate:
  - a. Store to prevent segregation and contamination with other sizes or foreign materials.
  - b. Obtain samples for testing from aggregates at point of batching.
  - c. Do not use frozen or partially frozen aggregates.
  - d. Do not use bottom 6 IN of stockpiles in contact with ground.

- e. Allow sand to drain until moisture content is uniform prior to use.
- 3. Admixtures:
  - a. Protect from contamination, evaporation, freezing, or damage.
  - b. Maintain within temperature range recommended by manufacturer.
  - c. Completely mix solutions and suspensions prior to use.
- 4. Reinforcing steel: Support and store all rebars above ground.
- B. Delivery:
  - 1. Concrete:
    - a. Prepare a delivery ticket for each load for ready-mixed concrete.
    - b. Truck operator shall hand ticket to Owner's Representative at the time of delivery.
    - c. Ticket to show:
      - 1) Mix identification mark.
      - 2) Quantity delivered.
      - 3) Amount of each material in batch.
      - 4) Outdoor temp in the shade.
      - 5) Time at which cement was added.
      - 6) Numerical sequence of the delivery.
      - 7) Amount of water added.
  - 2. Reinforcing steel:
    - a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
    - b. Mark numbers to match Shop Drawing mark number.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
  - 1. Nonshrink, nonmetallic grout:
    - a. Sika "SikaGrout 212."
    - b. Euclid Chemical "NS Grout."
    - c. BASF Admixtures, Inc. "Masterflow 713."
  - 2. Epoxy grout:
    - a. BASF Admixtures, Inc. "Brutem MPG."
    - b. Euclid Chemical Company, "E3-G."
    - c. Fosroc, "Conbextra EPHF".
  - 3. Expansion joint fillers:
    - a. Permaglaze Co.
    - b. Williams Products, Inc.
    - c. WR Meadows, Inc.
    - d. Right Pointe Co.
  - 4. Waterstops, PVC:
    - a. Greenstreak Plastic Products, Inc.
    - b. Burke Company.
    - c. Vinylex Corporation.
  - 5. Form coating:
    - a. Richmond "Rich Cote."
    - b. Industrial Lubricants "Nox-Crete Form Coating."
    - c. Euclid Chemical "Kurez DR VOX."
  - 6. Prefabricated forms:
    - a. Simplex "Industrial Steel Frame Forms."
    - b. Symons "Steel Ply."
    - c. Universal "Uniform."
  - 7. Chemical sealer:
    - a. L&M Construction Chemicals, Inc.
    - b. Euclid Chemical Company.

- 1 c. Dayton Superior.
- 2 8. Bonding agent:
- 3 a. Euclid Chemical Co.
- 4 b. BASF Admixtures, Inc.
- 5 c. L&M Construction Chemicals Inc.
- 6 B. Submit request for substitution in accordance with Specification Section 01 25 13.
- 7 **2.2 MATERIALS**
- 8 A. Portland Cement: Conform to ASTM C150 Type II.
- 9 B. Fly Ash:
- 10 1. ASTM C618, Class F or Class C.
- 11 2. Nonstaining.
- 12 a. Hardened concrete containing fly ash to be uniform light gray color.
- 13 3. Maximum loss on ignition: 4 percent.
- 14 4. Compatible with other concrete ingredients.
- 15 5. Obtain proposed fly ash from a source approved by the State Highway Department in the
- 16 state where the Project is located for use in concrete for bridges.
- 17 C. Admixtures:
- 18 1. Air entraining admixtures: ASTM C260.
- 19 2. Water reducing, retarding, and accelerating admixtures:
- 20 a. ASTM C494 Type A through E.
- 21 b. Conform to provisions of ACI 212.3R.
- 22 c. Do not use retarding or accelerating admixtures unless specifically approved in writing
- 23 by Engineer and at no cost to Owner.
- 24 d. Follow manufacturer's instructions.
- 25 e. Use chloride free admixtures only.
- 26 3. Maximum total water soluble chloride ion content contributed from all ingredients of
- 27 concrete including water, aggregates, cementitious materials and admixtures by weight
- 28 percent of cement:
- 29 a. 0.10 all concrete.
- 30 4. Do not use calcium chloride.
- 31 5. Pozzolanic admixtures: ASTM C618.
- 32 6. Provide admixtures of same type, manufacturer and quantity as used in establishing required
- 33 concrete proportions in the mix design.
- 34 D. Water: Potable, clean, free of oils, acids and organic matter.
- 35 E. Aggregates:
- 36 1. Normal weight concrete: ASTM C33, except as modified below.
- 37 2. Fine aggregate:
- 38 a. Clean natural sand.
- 39 b. No manufactured or artificial sand.
- 40 3. Coarse aggregate:
- 41 a. Crushed rock, natural gravel, or other inert granular material.
- 42 b. Maximum amount of clay or shale particles: 1 percent.
- 43 4. Gradation of coarse aggregate:
- 44 a. Lean concrete and concrete topping: Size #7.
- 45 b. All other concrete: Size #57 or #67.
- 46 F. Concrete Grout:
- 47 1. Nonshrink, nonmetallic grout:
- 48 a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
- 49 b. Grout to produce a positive but controlled expansion.
- 50 c. Mass expansion not to be created by gas liberation.
- 51 d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
- 52 e. In accordance with COE CRD-C621.

- 1 2. Epoxy grout:
  - 2 a. 3-component epoxy resin system.
    - 3 1) Two liquid epoxy components.
    - 4 2) One inert aggregate filler component.
  - 5 b. Each component packaged separately for mixing at jobsite.
- 6 G. Reinforcing Steel:
  - 7 1. Reinforcing bars: ASTM A615, Grade 60.
  - 8 2. Welded wire reinforcement:
    - 9 a. ASTM A185 or ASTM A1064.
    - 10 b. Minimum yield strength: 60,000 psi.
  - 11 3. Column spirals: ASTM A82 or ASTM A1064.
- 12 H. Forms:
  - 13 1. Prefabricated or job built.
  - 14 2. Wood forms:
    - 15 a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
    - 16 b. Built-in-place or prefabricated type panel.
    - 17 c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire
    - 18 area.
    - 19 d. When approved, plywood may be reused.
  - 20 3. Metal forms:
    - 21 a. Metal forms excluding aluminum may be used.
    - 22 b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide
    - 23 members of uniform thickness.
  - 24 4. Chamfer strips: Clear white pine, surface against concrete planed.
  - 25 5. Form ties:
    - 26 a. Removable end, permanently embedded body type with cones on outer ends not
    - 27 requiring auxiliary spreaders.
    - 28 b. Cone diameter: 3/4 IN minimum to 1 IN maximum.
    - 29 c. Embedded portion 1-1/2 IN minimum back from concrete face.
    - 30 d. If not provided with threaded ends, constructed for breaking off ends without damage to
    - 31 concrete.
    - 32 e. Provide ties with built-in waterstops at all walls that will be in contact with process
    - 33 liquid during plant operation.
  - 34 6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete
  - 35 surface.
- 36 I. Waterstops:
  - 37 1. Plastic: COE CRD-C572.
  - 38 2. Serrated with center bulb.
  - 39 3. Thickness: 3/8 IN.
  - 40 4. Length (general use): 6 IN unless indicated otherwise.
  - 41 5. Expansion joints:
    - 42 a. Length: 9 IN.
    - 43 b. Center bulb: 1 IN OD x 1/2 IN ID.
  - 44 6. Provide hog rings or grommets spaced at maximum 12 IN OC along the length of the water
  - 45 stop.
  - 46 7. Provide factory made waterstop fabrications at all changes of direction, intersections and
  - 47 transitions leaving only straight butt splices for the field.
- 48 J. Chairs, Runners, Bolsters, Spacers, and Hangers:
  - 49 1. Stainless steel, epoxy coated, or plastic coated metal.
    - 50 a. Plastic coated: Rebar support tips in contact with the forms only.
- 51 K. Chemical Floor Sealer:
  - 52 1. Colorless low VOC water-based solution containing acrylic copolymers.
    - 53 a. ASTM C1315, Class B, minimum 30 percent solids.

- 1                   2. L&M Construction Chemicals Inc. Dress & Seal WB 30.
- 2           L. Vapor Retarder:
- 3               1. ASTM E1745, Class A, minimum 15 mil thickness.
- 4               2. Water vapor permeance: 0.03 maximum per ASTM E96.
- 5               3. Puncture resistance: ASTM D1709, Method B, 2200 grams.
- 6               4. Minimum tensile strength: 45 LBS/IN, ASTM D882.
- 7               5. Vapor retarder tape: As recommended by vapor retarder manufacturer.
- 8           M. Membrane Curing Compound:
- 9               1. ASTM C309, Type I-D.
- 10              2. Resin based, dissipates upon exposure to UV light.
- 11              3. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
- 12              4. Curing compounds used in water treatment plant construction to be nontoxic and taste and
- 13               odor free.
- 14           N. Bonding Agent:
- 15               1. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to
- 16               improve adhesion and mechanical properties of concrete patching mortars.
- 17               2. Euclid Chemical Co. "Flex-Con."
- 18               3. BASF Admixtures, Inc. "Acryl-Set."
- 19               4. L&M Construction Chemicals "Everbond."
- 20               5. Thoro System Products "Acryl 60."
- 21           O. Expansion Joint Filler:
- 22               1. In contact with water or sewage:
- 23                  a. Closed cell neoprene.
- 24                  b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression
- 25               deflection (Grade SCE41).
- 26               2. Exterior driveways, curbs and sidewalks:
- 27                  a. Asphalt expansion joint filler.
- 28                  b. ASTM D994.
- 29               3. Other use:
- 30                  a. Fiber expansion joint filler.
- 31                  b. ASTM D1751.

## 32   2.3   CONCRETE MIXES

- 33           A. General:
- 34               1. All concrete to be ready mixed concrete conforming to ASTM C94/C94M.
- 35               2. Provide concrete of specified quality capable of being placed without segregation and, when
- 36               cured, of developing all properties required.
- 37               3. All concrete to be normal weight.
- 38           B. Strength:
- 39               1. Provide specified strength and type of concrete for each use in structure(s) as follows:
- 40

TYPE	WEIGHT	SPECIFIED STRENGTH*
All Concrete	Normal weight	4000 psi

41           \* Minimum 28-day compressive strength.

- 42           C. Air Entrainment:
- 43               1. Provide air entrainment in all concrete resulting in a total air content percent by volume as
- 44               follows:
- 45

MAX AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
1 IN or 3/4 IN	5 to 7
1/2 IN	5 1/2 to 8

2. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.
- D. Slump - 4 IN maximum, 1 IN minimum:
  1. Measured at point of discharge of the concrete into the concrete construction member.
  2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
  3. Pumped concrete:
    - a. Provide additional water at batch plant to allow for slump loss due to pumping.
    - b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
  4. Determine slump per ASTM C143.
- E. Selection of Proportions:
  1. General:
    - a. Proportion ingredients to:
      - 1) Produce proper workability, durability, strength, and other required properties.
      - 2) Prevent segregation and collection of excessive free water on surface.
  2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	MINIMUM CEMENT, LB/CY			MAXIMUM WATER CEMENT RATIO BY WEIGHT
	MAXIMUM AGGREGATE SIZE 1/2 IN	3/4 IN	1 IN	
4000	611	611	611	0.45

3. Substitution of fly ash: Maximum of 25 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
4. Sand cement grout:
  - a. Three parts sand.
  - b. One part Portland cement.
  - c. Entrained air: Six percent plus or minus one percent.
  - d. Sufficient water for required workability.
  - e. Minimum 28-day compressive strength: 3,000 psi.
5. Normal weight concrete:
  - a. Proportion mixture to provide desired characteristics using one of methods described below:
    - 1) Method 1 (Trial Mix):
      - a) Per ACI 318, Chapter 5, except as modified herein.
      - b) Air content within range specified above.
      - c) Record and report temperature of trial mixes.
      - d) Proportion trial mixes per ACI 211.1.
    - 2) Method 2 (Field Experience):
      - a) Per ACI 318, Chapter 5, except as modified herein:
      - b) Field test records must be acceptable to Engineer to use this method.
      - c) Test records shall represent materials, proportions and conditions similar to those specified.
6. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in Paragraph 5.3.1 of ACI 318.
- F. Flowable Fill Recommendations:
  1. Flowable fill shall be a mixture of cement, fly ash, fine sand, water and air having a consistency which will flow under a very low head.
  2. Approximate quantities of each component per cubic yard of mixed material:
    - a. Cement (Type II): Minimum 60 LBS.
    - b. Fly ash: 200 LBS.

- c. Fine sand: 2,700 LBS.
- d. Water (approximate): 420 LBS.
- e. Air content (approximate): 10 percent.
- 3. Actual quantities shall be adjusted to provide a yield of 1 CY with the materials used.
- 4. Approximate compressive strength should be 100 to 175 psi.
- 5. Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.
- G. Allowable Shrinkage: 0.048 percent per ASTM C157.

## **PART 3 - EXECUTION**

### **3.1 FORMING AND PLACING CONCRETE**

#### **A. Formwork:**

- 1. Contractor is responsible for design and erection of formwork.
- 2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
  - a. Allowable tolerances: As recommended in ACI 347.
- 3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
  - a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
  - b. Do not place floor drains through beams.
- 4. Openings:
  - a. Provide openings in formwork to accommodate work of other trades.
  - b. Accurately place and securely support items built into forms.
- 5. Chamfer strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
- 6. Clean and adjust forms prior to concrete placement.
- 7. Tighten forms to prevent mortar leakage.
- 8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.

#### **B. Reinforcement:**

- 1. Position, support and secure reinforcement against displacement.
- 2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
- 3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
- 4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
- 5. Extend reinforcement to within 2 IN of concrete perimeter edges.
  - a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
- 6. Minimum concrete protective covering for reinforcement: As shown on Drawings.
- 7. Do not weld reinforcing bars.
- 8. Welded wire reinforcement:
  - a. Install welded wire reinforcement in maximum practical sizes.
  - b. Splice sides and ends with a splice lap length measured between outermost cross wires of each fabric sheet not less than:
    - 1) One spacing of cross wires plus 2 IN.
    - 2) 1.5 x development length.
    - 3) 6 IN.
  - c. Development length: ACI 318 basic development length for the specified fabric yield strength.

#### **C. Construction, Expansion, and Contraction Joints:**

- 1. Provide at locations indicated.
- 2. Locate wall vertical construction joints at 30 FT maximum centers and wall horizontal construction joints at 10 FT maximum centers.

3. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
  4. Locate construction joints in columns and walls:
    - a. At the underside of beams, girders, haunches, drop panels, column capitals, and at floor panels.
    - b. Haunches, drop panels, and column capitals are considered part of the supported floor or roof and shall be placed monolithically therewith.
    - c. Column based need not be placed monolithically with the floor below.
  5. Locate construction joints in beams and girders:
    - a. At the middle of the span, unless a beam intersects a girder at that point.
    - b. If the middle of the span is at an intersection of a beam and girder, offset the joint in the girder a distance equal to twice the beam width.
    - c. Provide satisfactory means for transferring shear and other forces through the construction joint.
  6. Locate construction joints in suspended slabs:
    - a. At or near the center of span in flat slab or T-beam construction.
    - b. Do not locate a joint between a slab and a concrete beam or girder unless so indicated on Drawings.
  7. In pan-formed joists:
    - a. At or near span center when perpendicular to the joists.
    - b. Centered in the slab, midway between joists, when parallel to the joists.
  8. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
  9. At least 48 HRS shall elapse between placing of adjoining concrete construction.
  10. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
  11. Before new concrete is placed, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.
- D. Embedments:
1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
  2. Use setting diagrams, templates and instructions for locating and setting.
  3. Secure waterstops in correct position using hog rings or grommets spaced along the length of the waterstop and wire tie to adjacent reinforcing steel.
- E. Placing Concrete:
1. Place concrete in compliance with ACI 304R and ACI 304.2R.
  2. Place in a continuous operation within planned joints or sections.
  3. Begin placement when work of other trades affecting concrete is completed.
  4. Place concrete by methods which prevent aggregate segregation.
  5. Do not allow concrete to free fall more than 4 FT.
  6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.
- F. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.
- G. Protection:
1. Protect concrete from physical damage or reduced strength due to weather extremes.
  2. In cold weather comply with ACI 306R except as modified herein.
    - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
    - b. Minimum concrete temperature at the time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
--	-----------------------------------

Below 30 DegF	70 DegF
Between 30-45 DegF	60 DegF
Above 45 DegF	50 DegF

- c. Do not place heated concrete that is warmer than 80 DegF.
- d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.
- e. Do not allow concrete to cool suddenly.
3. In hot weather comply with ACI 305R except as modified herein.
  - a. At air temperature of 90 DegF and above, keep concrete as cool as possible during placement and curing.
  - b. Do not allow concrete temperature to exceed 90 DegF at placement.
  - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
  - d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.

#### H. Curing:

1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
4. Provide curing for minimum of 7 days.
5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
6. In hot weather follow curing procedures outlined in ACI 305R.
7. In cold weather follow curing procedures outlined in ACI 306R.
8. If forms are removed before 7 days have elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.
9. Curing vertical surfaces with a curing compound:
  - a. Cover vertical surfaces with a minimum of two coats of the curing compound.
  - b. Allow the preceding coat to completely dry prior to applying the next coat.
  - c. Apply the first coat of curing compound immediately after form removal.
  - d. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
  - e. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.

#### I. Form Removal:

1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
2. Where no reshoring is planned, leave forms and shoring used to support concrete until it has reached its specified 28-day compressive strength.
3. Where reshoring is planned, supporting formwork may be removed when concrete has sufficient strength to safely support its own weight and loads placed thereon.
  - a. While reshoring is underway, no superimposed loads shall be permitted on the new construction.
  - b. Place reshores as soon as practicable after stripping operations are complete but in no case later than the end of working day on which stripping occurs.
  - c. Tighten reshores to carry their required loads.
  - d. Leave reshores in place until concrete being supported has reached its specified 28-day compressive strength.

## 3.2 CONCRETE FINISHES

#### A. Tolerances:

1. Class A: 1/8 IN in 10 FT.
2. Class B: 1/4 IN in 10 FT.

- 1 B. Surfaces Exposed to View:
- 2 1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
- 3 a. To be covered with a coating or covering material applied directly to concrete.
- 4 b. Scheduled for grout cleaned finish.
- 5 2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with
- 6 cement grout.
- 7 3. Fill tie holes with nonshrink, nonmetallic grout.
- 8 C. Surfaces Not Exposed to View:
- 9 1. Patch voids, air pockets and honeycomb areas with cement grout.
- 10 2. Fill tie holes with nonshrink, nonmetallic grout.
- 11 D. Grout Cleaned Finish:
- 12 1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient bonding agent/water
- 13 mixture to produce a grout with the consistency of thick paint.
- 14 a. White Portland cement shall be substituted for gray Portland cement to produce a color
- 15 that matches color of surrounding concrete as determined by trial patch for areas not to
- 16 be painted.
- 17 2. Wet surface of concrete to prevent absorption of water by grout and uniformly apply grout
- 18 with brushes or spray gun.
- 19 3. Immediately scrub the surface with a cork float or stone to coat and fill air bubbles and
- 20 holes.
- 21 4. While grout is still plastic, remove all excess grout by working surface with rubber float,
- 22 sack or other approved means.
- 23 5. After the surface whitens from drying, rub vigorously with clean burlap.
- 24 6. Keep final finish damp for a minimum of 36 HRS after final rubbing.
- 25 E. Slab Float Finish:
- 26 1. After concrete has been placed, consolidated, struck off, and leveled, do no further work
- 27 until ready for floating.
- 28 2. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to
- 29 permit operation.
- 30 3. During or after first floating, check planeness of entire surface with a 10 FT straightedge
- 31 applied at not less than two different angles.
- 32 4. Cut down all high spots and fill all low spots during this procedure to produce a surface
- 33 within Class B tolerance throughout.
- 34 5. Refloat slab immediately to a uniform sandy texture.
- 35 F. Troweled Finish:
- 36 1. Float finish surface.
- 37 2. Next power trowel, and finally hand trowel.
- 38 3. Produce a smooth surface which is relatively free of defects with first hand troweling.
- 39 4. Perform additional trowelings by hand after surface has hardened sufficiently.
- 40 5. Final trowel when a ringing sound is produced as trowel is moved over surface.
- 41 6. Thoroughly consolidate surface by hand troweling.
- 42 7. Leave finished surface essentially free of trowel marks, uniform in texture and appearance
- 43 and plane to a Class A tolerance.
- 44 8. On surfaces intended to support floor coverings remove any defects of sufficient magnitude
- 45 that would show through floor covering by grinding.
- 46 G. Broom Finish: Immediately after concrete has received a float finish as specified, give it a
- 47 transverse scored texture by drawing a broom across surface.
- 48 H. Apply chemical floor hardener to permanently exposed interior concrete floor slab surfaces
- 49 where indicated.
- 50 1. Apply in accordance with manufacturer's instructions.

### 51 3.3 GROUT

#### 52 A. Preparation:

City of Carlsbad, NM  
May 2015

Effluent Reuse Transfer Pump Station  
Contract Documents

1. Nonshrinking, nonmetallic grout:
    - a. Clean concrete surface to receive grout.
    - b. Saturate concrete with water for 24 HRS prior to grouting.
  2. Rock anchors:
    - a. Clean rock anchors of all loose material.
    - b. Orient hook or bends in anchor bars to clear anchor bolts, reinforcements, and other embedments to be installed later.
  3. Epoxy grout: Apply only to clean, dry, roughened, sound surface.
- B. Application:
1. Nonshrinking, nonmetallic grout:
    - a. Mix in a mechanical mixer.
    - b. Use no more water than necessary to produce flowable grout.
    - c. Place in accordance with manufacturer's instructions.
    - d. Completely fill all spaces and cavities below the bottom of baseplates.
    - e. Provide forms where baseplates and bedplates do not confine grout.
    - f. Where exposed to view, finish grout edges smooth.
    - g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
    - h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
    - i. Wet cure grout for seven (7) days, minimum.
  2. Rock anchors:
    - a. See Item 1 above.
    - b. If rodded:
      - 1) Fill each hole so that it overflows when anchor bar is inserted.
      - 2) Force anchor bars into place.
    - c. If pressure placed, set anchor bar before grouting.
    - d. Take special care to avoid any movement of anchors that have been placed.
  3. Epoxy grout:
    - a. Mix and place in accordance with manufacturer's instructions.
    - b. Completely fill all cavities and spaces around dowels and anchors without voids.
    - c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

### 3.4 FIELD QUALITY CONTROL

- A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
1. Contractor to cooperate with Owner in obtaining and testing samples.
- B. Tests During Construction:
1. Strength test - procedure:
    - a. Three cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and ASTM C31.
    - b. Cylinders will be tested per ASTM C39:
      - 1) One (1) at seven (7) days.
      - 2) Two (2) at 28 days.
  2. Strength test - frequency:
    - a. Not less than one test each day concrete placed.
    - b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
    - c. Not less than one test for each type of concrete poured.
    - d. Not less than one test for each concrete structure exceeding 2 CY volume.
  3. Slump test:
    - a. Per ASTM C143.
    - b. Determined for each strength test sample.
    - c. Additional slump tests may be taken.
  4. Air content:
    - a. Per ASTM C231, ASTM C173, and ASTM C138.
    - b. Determined for each strength test sample.

- 1           5. Temperature: Determined for each strength test sample.
- 2       C. Evaluation of Tests:
- 3           1. Strength test results:
- 4               a. Average of 28-day strength of two cylinders from each sample.
- 5                   1) If one cylinder manifests evidence of improper sampling, molding, handling,
- 6                   curing or testing, strength of remaining cylinder will be test result.
- 7                   2) If both cylinders show any of above defects, test will be discarded.
- 8       D. Acceptance of Concrete:
- 9           1. Strength level of each type of concrete shall be considered satisfactory if both of the
- 10           following requirements are met:
- 11               a. Average of all sets of three consecutive strength tests equals or exceeds the required
- 12               specified 28-day compressive strength.
- 13               b. No individual strength test falls below the required specified 28-day compressive
- 14               strength by more than 500 psi.
- 15           2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective
- 16           measures as directed by Engineer.
- 17               a. Perform additional tests and/or corrective measures at no additional cost to Owner.

### 18   **3.5 SCHEDULES**

#### 19   A. Form Types:

- 20           1. Surfaces exposed to view:
- 21               a. Prefabricated or job-built wood forms.
- 22               b. Laid out in a regular and uniform pattern with long dimensions vertical and joints
- 23               aligned.
- 24               c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex
- 25               areas.
- 26               d. Construct forms sufficiently tight to prevent leakage of mortar.
- 27           2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms
- 28           sufficiently tight to prevent leakage of mortar.
- 29           3. Other types of forms may be used:
- 30               a. For surfaces not restricted to plywood or lined forms.
- 31               b. As backing for form lining.

#### 32   B. Grout:

- 33           1. Nonshrinking, nonmetallic grout: General use.
- 34           2. Epoxy grout:
- 35               a. Grouting of dowels and anchor bolts into existing concrete.
- 36               b. Other uses indicated on Drawings.
- 37           3. Sand cement grout: Keyways of precast members.

#### 38   C. Concrete:

- 39           1. Precast concrete: Where indicated on Drawings.
- 40           2. Lean concrete: Where indicated on Drawings.
- 41           3. Concrete fill: Where indicated on Drawings.
- 42           4. Lightweight concrete: Where indicated on Drawings.
- 43           5. Normal weight concrete: All concrete.
- 44           6. Concrete pan fill: Stair and landings where indicated on Drawings.
- 45           7. General use concrete: All other locations.

#### 46   D. Concrete Finishes:

- 47           1. Grout cleaned finish: Where indicated on Drawings.
- 48           2. Slab finishes:
- 49               a. Use following finishes as applicable, unless otherwise indicated:
- 50                   1) Floated finish: Surfaces intended to receive roofing, concrete topping, lean
- 51                   concrete, concrete fill and waterproofing.

- 1
  - 2
  - 3
- 2) Troweled finish: Interior floor slabs, exposed roof slabs and base slabs of structures, equipment bases, and column bases.
  - 3) Broom finish: Sidewalks, docks, concrete stairs, and ramps.

5

**END OF SECTION**



**SECTION 055 50 00**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other sections.
  2. Design of all temporary bracing not indicated on Drawings.
- B. Related Sections include but are not necessarily limited to:
1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 1 - General Requirements.
  3. Section 09 91 00 - Painting and Protective Coatings.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. Aluminum Association (AA):
    - a. Aluminum Design Manual.
  2. American Association of State Highway and Transportation Officials (AASHTO):
    - a. Standard Specification for Highway Bridges.
  3. American Institute of Steel Construction (AISC):
    - a. Specifications for Structural Steel Buildings (referred to herein as AISC specification).
  4. American National Standards Institute (ANSI):
    - a. A14.3, Ladders-Fixed-Safety Requirements.
    - b. ANSI MBG 531, Metal Bar Grating Manual.
    - c. ANSI MBG 532, Heavy-Duty Metal Bar Grating Manual.
  5. American Society for Testing and Materials (ASTM):
    - a. A36, Specification for Carbon Structural Steel.
    - b. A47, Specification for Ferritic Malleable Iron Castings.
    - c. A48, Specification for Gray Iron Castings.
    - d. A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
    - e. A108, Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
    - f. A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
    - g. A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    - h. A197, Specification for Cupola Malleable Iron.
    - i. A269, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
    - j. A276, Specification for Stainless Steel Bars and Shapes.
    - k. A307, Specification Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
    - l. A312, Specification for Seamless and Welded Austenitic Seamless Steel Pipe.
    - m. A325, Specification of Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
    - n. A496, Specification for Steel Wire, Deformed, for Concrete Reinforcement.
    - o. A500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
    - p. A501, Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
    - q. A536, Specification for Ductile Iron Castings.
    - r. A554, Specification for Welded Stainless Steel Mechanical Tubing.
    - s. A563, Specification for Carbon and Alloy Steel Nuts.

- t. A572, Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
  - u. A582, Specification for Free-Machining Stainless Steel Bars.
  - v. A666, Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - w. A668, Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
  - x. A780, Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings.
  - y. A786, Specification for Rolled Steel Floor Plates.
  - z. A924, Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - aa. B26, Specification for Aluminum-Alloy Sand Castings.
  - bb. B36, Specification for Brass Plate, Sheet, Strip, and Rolled Bar.
  - cc. B221, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - dd. B308, Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes.
  - ee. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
  - ff. B632, Specification for Aluminum-Alloy Rolled Tread Plate.
  - gg. F467, Specification for Non-Ferrous Nuts for General Use.
  - hh. F468, Specification for Non-Ferrous Bolts, Hex Cap Screws, and Studs for General Use.
  - ii. F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  - jj. F594, Specification for Stainless Steel Nuts.
6. American Welding Society (AWS):
    - a. A5.1, Standard Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
    - b. D1.1, Structural Welding Code Steel.
    - c. D1.2, Structural Welding Code Aluminum.
  7. National Association of Architectural Metal Manufacturers (NAAMM):
    - a. AMP 510, Metal Stairs Manual.
  8. Research Council on Structural Connections:
    - a. Specification for Structural Joints Using ASTM A325 or A490 Bolts (referred to herein as Specification for Structural Joints).
  9. U. S. Department of Labor, Occupational Safety and Health Administration (OSHA):
    - a. 29 CFR 1910, OSHA Safety and Health Standards for General Industry (referred to herein as OSHA standards).
  10. Provide all fabricated items complying with 2003 International Building Code (IBC) Building Code and OSHA Regulations.
- B. Qualifications:
1. Qualify welding procedures and welding operators in accordance with AWS.
  2. Fabricator shall have minimum of 10 years experience in fabrication of metal items specified.
  3. Shop drawings and engineering design calculations for components of contractor-designed digester bridge, stairs, landings, and ladders with design live loads noted, shall be sealed by Professional Structural Engineer licensed in the State of New Mexico, and will be reviewed by the Engineer for general compliance with the Contract Documents.

### 1.3 DEFINITIONS

- A. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.
  1. Installer or applicator are synonymous.
- B. Hardware: As defined in ASTM A153.
- C. Galvanizing: Hot-dip galvanizing per ASTM A123 or A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

## 1.4 SUBMITTALS

### A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Fabrication and/or layout drawings and details:
  - a. Submit drawings for all fabrications and assemblies. Include erection drawings, plans, sections, details and connection details.
  - b. Identify materials of construction, shop coatings and third party accessories.
3. Product technical data including:
  - a. Acknowledgement that products submitted meet requirements of standards referenced.
  - b. Manufacturer's installation instructions.
  - c. Provide manufacturer's standard allowable load tables for the following:
    - 1) Grating and checkered plate.
    - 2) Expansion anchor bolts.
    - 3) Adhesive anchor bolts.
    - 4) Castings, trench covers and accessories.

### B. Miscellaneous Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Certification of welders and welding processes.
  - a. Indicate compliance with AWS.

## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver and handle fabrications to avoid damage.
- B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  1. Abrasive stair nosings (embedded in concrete stairs) where noted:
    - a. American Safety Tread.
    - b. Balco.
  2. Headed studs and deformed bar anchors:
    - a. Nelson Stud Welding Div., TRW Inc.
    - b. Stud Welding Products, Inc.
  3. Expansion anchor bolts:
    - a. Hilti Inc.
    - b. ITW Ramset/Red Head.
    - c. Powers Rawl.
  4. Epoxy adhesive anchor bolts:
    - a. Hilti Inc.
    - b. ITW Ramset/Red Head.
    - c. Powers Rawl.
  5. Castings, trench covers and accessories:
    - a. Neenah Foundry Co.
    - b. Deeter Foundry Co.
    - c. Barry Craft Construction Casting Co.
    - d. McKinley Iron Works.
  6. Galvanizing repair paint.

- 1 a. TNEMEC.
- 2 b. ZRC Products.
- 3 7. Metal (Modular) framing system:
- 4 a. Unistrut Building Systems.
- 5 b. B-Line Systems.
- 6 c. Kindorf.
- 7 d. Metal Products Div., USG Industries, Inc.
- 8 e. Mono-Systems, Inc.
- 9 8. Ladder safety extension post.
- 10 a. Bilco.
- 11 B. Submit requests for substitution in accordance with Specification Section 01 25 13.

12 **2.2 MATERIALS**

- 13 A. Steel:
- 14 1. Structural Shapes: ASTM A992, Grade 50. Plates, bars and angles: ASTM A36.
- 15 2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
- 16 3. Structural tubing:
- 17 a. ASTM A500, Grade B (46 ksi minimum yield).
- 18 4. Rolled-steel floor plates: ASTM A786, rolled from plates complying with ASTM A36 or
- 19 ASTM A283 Grade C or D.
- 20 5. Bolts, nuts and washers, high strength: ASTM A325.
- 21 a. Provide two washers with all bolts.
- 22 6. Bolts and nuts: Unfinished, ASTM A307, Grade A.
- 23 a. Zinc plated.
- 24 7. Welding electrodes: AWS D1.1, E70 Series.
- 25 8. Steel forgings: ASTM A668.
- 26 B. Iron:
- 27 1. Ductile iron: ASTM A536.
- 28 2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).
- 29 3. Malleable iron: ASTM A47, A197.
- 30 C. Stainless Steel:
- 31 1. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.
- 32 a. Bars, shapes: ASTM A276, Type 304.
- 33 b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
- 34 c. Strip, plate and flat bars: ASTM A666, Type 304 or 316, Grade A.
- 35 d. Bolts and nuts: ASTM F593, Type 303, 304 or 316.
- 36 2. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
- 37 a. Strip, plate and flat bar for welded connections, ASTM A666, type 304L or 316L.
- 38 3. Welding electrodes: In accordance with AWS for metal alloy being welded.
- 39 D. Aluminum:
- 40 1. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
- 41 a. ASTM B221 and B308 for shapes including beams, channels, angles, tees and zeos.
- 42 b. Weir plates and baffles.
- 43 2. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
- 44 a. ASTM B221 and B429 for bars, rods, wires, pipes and tubes.
- 45 3. ASTM B26 for castings.
- 46 4. ASTM F468, alloy 2024 T4 for bolts.
- 47 5. ASTM F467, alloy 2024 T4 for nuts.
- 48 6. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.
- 49 E. Washers: Same material and alloy as found in accompanying bolts and nuts.
- 50 F. Embedded Anchor Bolts:
- 51 1. Type 304 or 316 stainless steel with matching nut and washer.

- 1 G. Expansion Anchor Bolts and Adhesive Anchor Bolts:
- 2 1. Stainless steel, Type 304, 314 or 316.
- 3 2. Provide minimum edge distance cover and spacing as recommended by manufacturer, or as
- 4 indicated on Drawings whichever is larger.
- 5 a. Minimum embedment as recommended by manufacturer or eight diameters of bolt,
- 6 whichever is larger.
- 7 b. Notify Engineer if required depth of embedment cannot be achieved at a particular
- 8 anchor bolt location.
- 9 c. Follow manufacturer's recommendations for installation and torque.
- 11 H. Adhesive Anchors:
- 12 1. HVA adhesive anchor system by Hilti. HIT HY 150 Adhesive by Hilti.
- 13 2. Provide adhesive capsules for anchoring reinforcing where indicated on Drawings.
- 14 Embedment length shall be minimum as indicated on Drawings, or per manufacturer's
- 15 recommendation.
- 16 3. Provide edge distance cover as recommended by manufacturer, or as indicated on Drawings.
- 17 I. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile
- 18 strength of 60,000 psi.
- 19 J. Deformed Bar Anchors: ASTM A496 with a minimum yield strength of 70,000 psi and a
- 20 minimum tensile strength of 80,000 psi.
- 21 K. Iron and Steel Hardware: Galvanized in accordance with ASTM A153 when required to be
- 22 galvanized.
- 23 L. Galvanizing Repair Paint:
- 24 1. High zinc dust content paint for regalvanizing welds and abrasions.
- 25 2. Dried film shall contain not less than 83 percent zinc dust by weight.
- 26 3. Similar to ZRC by ZRC Products or TNEMEC Series 90-97.

## 27 2.3 MANUFACTURED UNITS

- 28 A. Abrasive Stair Nosings where noted:
- 29 1. Two component consisting of an embedded subchannel, installed with the concrete pour,
- 30 and an abrasive tread plate to be installed later.
- 31 2. 6063-T5 extruded aluminum, mill finished and heat treated.
- 32 3. Complete with concrete anchors and tread plate securing screws.
- 33 4. Units: 4 IN less in length than stair width.
- 34 B. Metal Inserts Used in Concrete Construction:
- 35 1. Factory fabricated.
- 36 2. Galvanized steel.

## 37 2.4 FABRICATION

- 38 A. Verify field conditions and dimensions prior to fabrication.
- 39 B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
- 40 1. Grind smooth all rough welds and sharp edges.
- 41 a. Round all corners to approximately 1/8 IN nominal radius.
- 42 C. Provide drilled or punched holes with smooth edges.
- 43 1. Punch or drill for field connections and for attachment of work by other trades.
- 44 D. Weld Permanent Shop Connections:
- 45 1. Welds to be continuous fillet type unless indicated otherwise.
- 46 2. Full penetration butt weld at bends in stair and ladder stringers.
- 47 3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming
- 48 to AWS A5.1.
- 49 4. Weld aluminum in accordance with AWS D1.2.
- 50 5. Grind smooth welds that will be exposed.

- E. Conceal fastenings where practicable.
- F. Fabricate work in shop in as large assemblies as is practicable.
- G. Tolerances:
  - 1. Rolling: ASTM A6.
    - a. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC specifications.
  - 2. Fabrication tolerance:
    - a. Member length:
      - 1) Both ends finished for contact bearing: 1/32 IN.
      - 2) Framed members 30 FT or less: 1/16 IN. Over 30 FT: 1/8 IN.
    - b. Member straightness:
      - 1) Compression members: 1/1000 of axial length between points laterally supported.
      - 2) Non-compression members: ASTM A6/A6M tolerance for wide flange shapes.
    - c. Specified member camber (except compression members):
      - 1) 50 FT or less: Minus 0/plus 1/2 IN.
      - 2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
      - 3) Members received from mill with 75 percent of specified camber require no further cambering.
      - 4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
      - 5) Camber shall be measured in fabrication shop in unstressed condition.
    - d. At bolted splices, depth deviation shall be taken up by filler plates. At welded joints, adjust weld profile to conform to variation in depth. Slope weld surface per AWS requirements.
    - e. Finished members shall be free from twists, bends and open joints. Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.
- H. Fabricate grating, stairs, and checker plate accessories using aluminum unless shown otherwise as noted on Drawings.
  - 1. Finish:
    - a. Coat surfaces in contact with dissimilar materials.
      - 1) See Specification Section 09 91 00 for preparation and painting of ferrous metals and other surfaces.
- I. Maximum tolerance for difference in depth between checker plate or grating depth and seat or support angle depth: 1/8 IN.
- J. Maximum distance between edge of grating and face of embedded seat angle or face of wall or other structural member: 0.25 IN.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Prior to installation, inspect and verify condition of substrate. Installation of product constitutes installer's acceptance of substrate condition for product compatibility.
- B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
  - 1. Field welding aluminum is not permitted unless approved in writing by Engineer.

### **3.2 INSTALLATION**

- A. Set metal work level, true to line, plumb.
  - 1. Shim and grout as necessary.

- 1 B. Bolt Field Connections: Where practicable, conceal fastenings.
- 2 C. Grind welds smooth where field welding is required.
- 3 D. Field cutting grating or checkered plate to correct fabrication errors is not acceptable. Replace  
4 entire section.
- 5 E. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing  
6 system elements, etc.
- 7 F. Unless noted or specified otherwise:
- 8 1. Connect steel members to steel members with 7/8 IN DIA ASTM A325 high strength bolts.
- 9 2. Connect aluminum to aluminum with 3/4 IN DIA aluminum bolts.
- 10 3. Connect aluminum to structural steel using 3/4 IN DIA stainless steel bolts. Provide  
11 dissimilar metals protection.
- 12 4. Connect aluminum and steel members to concrete and masonry using stainless steel  
13 adhesive anchor bolts unless shown otherwise. Provide dissimilar materials protection.
- 14 5. Provide washers for all bolted connections.
- 15 G. Install and tighten ASTM A325 high-strength bolts in accordance with 9th Edition of Manual of  
16 Steel Construction.
- 17 1. Provide hardened washers for all ASTM A325 bolts. Provide the hardened washer under the  
18 element (nut or bolt head) turned in tightening.
- 19 H. After bolts are tightened, upset threads of A307 unfinished bolts or anchor to prevent nuts from  
20 backing off.
- 21 I. Secure metal to wood with lag screws of adequate size with appropriate washers.
- 22 J. Do not field splice fabricated items unless said items exceed standard shipping length or change  
23 of direction requires splicing. Provide full penetration welded splices where continuity is  
24 required.
- 25 K. Provide each fabricated item complete with attachment devices as indicated or required to  
26 install.
- 27 L. Anchor such that work will not be distorted nor fasteners overstressed from expansion and  
28 contraction.
- 29 M. Set beam and column base plates accurately on nonshrink grout as indicated on Drawings.
- 30 1. See Division 3 for non-shrink grout.
- 31 2. Set and anchor each base plate to proper line and elevation.
- 32 a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and  
33 beams. Wedges, shims and setting nuts to be of same metal as base plate they support.  
34 Tighten nuts on anchor bolts.
- 35 b. Fill space between bearing surface and bottom of base plate with nonshrink grout. Fill  
36 space until voids are completely filled and base plates are fully bedded on wedges,  
37 shims, and grout.
- 38 c. Do not remove wedges or shims. Where they protrude, cut off flush with edge of base  
39 plate.
- 40 d. Fill sleeves around anchor bolts solid with non-shrink grout.
- 41 N. Tie anchor bolts in position to embedded reinforcing steel using wire. Tack welding prohibited.  
42 Coat bolt threads and nuts with heavy coat of clean grease. Anchor bolt location tolerance: 1/16  
43 IN. Provide steel templates for all column anchor bolts.
- 44 O. Provide angle nosing at each concrete stair landing having aluminum or steel grating stair  
45 structure attaching to the concrete landing.
- 46 P. Accurately locate and place frames for openings before casting into floor slab so top of plate is  
47 flush with surface of finished floor. Keep screw holes clean and ready to receive screws.
- 48 Q. Attach grating to end and intermediate supports with grating saddle clips and bolts.

- 1           1. Maximum spacing: 2 FT OC with minimum of two per side.
- 2           2. Attach individual units of aluminum grating together with clips at 2 FT OC maximum with
- 3           a minimum of two clips per side.
- 4       R. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification
- 5       Section 09 91 00.
- 6       S. Repair damaged galvanized surfaces in accordance with ASTM A780.
- 7           1. Prepare damaged surfaces by abrasive blasting or power sanding.
- 8           2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's
- 9           instructions.

10   **3.3   CLEANING**

- 11       A. After erection, installation or application, clean all miscellaneous metal fabrication surfaces of
- 12       all dirt, weld slag and other foreign matter.
- 13       B. Refer to Specification Section 09 91 00 for repairing damaged shop-applied coatings.

14                                   **END OF SECTION**

**SECTION 09 91 00**  
**PAINTING AND PROTECTIVE COATINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. High performance industrial coatings (HPIC).
  2. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
  3. Minimum surface preparation requirements.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
  3. Section 10 14 00 - Identification Devices.
  4. Section 05 55 00 - Metal Fabrications.
  5. Section 40 05 05 - Equipment: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. ASTM International (ASTM):
    - a. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
    - b. D4259, Standard Practice for Abrading Concrete.
    - c. D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
    - d. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
    - e. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
    - f. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
  2. NACE International (NACE).
  3. National Association of Pipe Fabricators (NAPF):
    - a. 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings:
      - 1) 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe.
      - 2) 500-03-05, Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
  4. National Bureau of Standards (NBS):
    - a. Certified Coating Thickness Calibration Standards.
  5. National Fire Protection Association (NFPA):
    - a. 101, Life Safety Code.
  6. NSF International (NSF).
  7. Steel Door Institute/American National Standards Institute (SDI/ANSI):
    - a. A250.10, Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces for Steel Doors and Frames.
  8. The Society for Protective Coatings (SSPC):
    - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
    - b. SP 1, Solvent Cleaning.
    - c. SP 2, Hand Tool Cleaning.
    - d. SP 3, Power Tool Cleaning.
    - e. SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
  9. The Society for Protective Coatings/NACE International (SSPC/NACE):

- a. SP 5/NACE No. 1, White Metal Blast Cleaning.
  - b. SP 6/NACE No. 3, Commercial Blast Cleaning.
  - c. SP 7/NACE No. 4, Brush-off Blast Cleaning.
  - d. SP 10/NACE No. 2, Near-White Blast Cleaning.
  - e. SP 12/NACE No. 5, Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating.
  - f. SP 13/NACE No. 6, Surface Preparation of Concrete.
- B. Qualifications:
- 1. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.
  - 2. Applicators shall have minimum of 10 years experience in application of similar products on similar project.
    - a. Provide references for minimum of three (3) different projects completed in last five (5) years with similar scope of work.
    - b. Include name and address of project, size of project in value (painting) and contact person.
- C. Miscellaneous:
- 1. Furnish paint through one (1) manufacturer unless noted otherwise.
  - 2. Coating used in all corridors and stairways shall meet requirements of NFPA 101 and ASTM E84.
- D. Deviation from specified mil thickness or product type is not allowed without written authorization of Engineer.
- E. Material shall not be thinned unless approved, in writing, by paint manufacturer's authorized representative.

### 1.3 DEFINITIONS

- A. Installer or Applicator:
- 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
  - 2. Installer and applicator are synonymous.
- B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified or in Specification Section 40 05 05.
- C. Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to condensation, spillage or splash of a corrosive material such as water, wastewater, or chemical solution; or exposure to corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range of 5 to 9.
- D. Highly Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to condensation, spillage or splash of a highly corrosive material such as water, wastewater, or chemical solution; or exposure to highly corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range below five (5) or above nine (9).
- E. Exposed Exterior Surface:
- 1. Surface which is exposed to weather but not necessarily exposed to view as well as surface exposed to view.
  - 2. Exterior surfaces are considered corrosive environment.
    - a. The following areas are considered highly corrosive:
      - 1) All chemical unloading stations and areas within 10 FT-0 IN of containment areas.
      - 2) All chemical unloading station containment areas.
      - 3) All areas within a 6 FT radius of chemical tank vents.

- 1 F. Finished Area: An area that is listed in or has finish called for on Room Finish Schedule or is  
2 indicated on Drawings to be painted.
- 3 G. Immersion Surface:  
4 1. Any surface immersed in water or some other liquid.  
5 2. Surface of any pipe, valve, or any other component of the piping system subject to  
6 condensation including the pipe support system.
- 7 H. Paint includes the following:  
8 1. High performance industrial coatings (HPIC) include: Epoxies, urethanes, vinyl ester,  
9 waterborne vinyl acrylic emulsions, acrylates, silicones, alkyds, acrylic emulsions and any  
10 other coating listed as a HPIC.
- 11 I. Surface Hidden from View: Surfaces such as those within pipe chases, surfaces between top  
12 side of ceilings (including drop-in tile ceilings) and underside of floor or roof structures above,  
13 surfaces under overhanging walkways if over five feet above adjacent walking surfaces
- 14 J. AP: Architectural paints.
- 15 K. HPIC: High performance industrial coatings.
- 16 L. SC: Special coatings.
- 17 M. Water level for purposes of painting: See Drawings.

#### 18 **1.4 SUBMITTALS**

- 19 A. Shop Drawings:  
20 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
21 the submittal process.  
22 2. Applicator experience qualifications.  
23 a. No submittal information will be reviewed until Engineer has received and approved  
24 applicator qualifications.  
25 3. Product technical data including:  
26 a. Acknowledgement that products submitted meet requirements of standards referenced.  
27 b. Manufacturer's application instructions.  
28 c. Manufacturer's surface preparation instructions.  
29 d. If products being used are manufactured by Company other than listed in the  
30 MATERIALS Article of this Specification Section, provide complete individual data  
31 sheet comparison of proposed products with specified products including application  
32 procedure, coverage rates and verification that product is designed for intended use.  
33 e. Contractor's written plan of action for containing airborne particles created by blasting  
34 operation and location of disposal of spent contaminated blasting media.  
35 f. Coating manufacturer's recommendation on abrasive blasting.  
36 g. Manufacturer's recommendation for universal barrier coat.  
37 h. Manufacturer's recommendation for providing temporary or supplemental heat or  
38 dehumidification or other environmental control measures.  
39 4. Manufacturer's statement regarding applicator instruction on product use.  
40 5. Certification that High Performance Coating Systems proposed for use have been reviewed  
41 and approved by Senior Corrosion Specification Specialist employed by the coating  
42 manufacturer.
- 43 B. Samples:  
44 1. Manufacturer's full line of colors for Engineer's preliminary color selection.  
45 2. After preliminary color selection by Engineer provide two (2) 3 x 5 IN samples of each final  
46 color selected.
- 47 C. Informational Submittals:  
48 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
49 the submittal process.

2. Approval of application equipment.
3. Applicator's daily records:
  - a. Submit daily records at end of each week in which painting work is performed unless requested otherwise by Engineer's on-site representative.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver in original containers, labeled as follows:
  1. Name or type number of material.
  2. Manufacturer's name and item stock number.
  3. Contents, by volume, of major constituents.
  4. Warning labels.
  5. VOC content.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable:
  1. High performance industrial coatings:
    - a. Tnemec.
    - b. ICI Devco.
    - c. Carboline Protective Coatings.
    - d. Sherwin Williams.
    - e. Dampney Company, Inc.
    - f. PPG Industries/Amercoat.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.
  1. Product VOC content will be an important factor when determining acceptability of substitution.

### **2.2 MATERIALS**

- A. For unspecified materials such as thinner, provide manufacturer's recommended products.
- B. Paint Systems - General:
  1. P = prime coat.
  2. F1, F2 . . . Fn = first finish coat, second finish coat . . . nth finish coat, color as selected by Engineer.
  3. If two (2) finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one (1) coat equal to mil thickness of two (2) coats specified.
- C. HPIC products listed in the MATERIALS Article, Paint Systems paragraph are manufactured by Tnemec.
  1. Products of other listed manufacturers are acceptable for use providing the product is of the same generic resin, requires comparable surface preparation, has comparable application requirements, meets the same VOC levels or better, provides the same finish and color options and will withstand the atmospheric conditions of the location where it is to be applied.
- D. Paint Systems (Systems not shown are not used):
  1. HPIC SYSTEM #2 - Zinc-Rich Urethane Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Finish Coat(s).
    - a. Prime coat:
      - 1) P1 = 1 coat, 3.5 mils, Series 90-97 Tnemec-Zinc (Zinc-Rich Urethane).
    - b. Finish coat(s):

- 1) Interior:
  - a) F1 = 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
- 2) Exterior:
  - a) F1 = 1 coat, 6 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
  - b) F2 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B.(Waterborne Acrylic Polyurethane).
2. HPIC SYSTEM #3 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
  - a. Prime coat:
    - 1) P1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
  - b. Finish coat(s):
    - 1) Interior:
      - a) F1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
    - 2) Exterior:
      - a) F1 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).
3. HPIC SYSTEM #19 - Polyamidoamine Epoxy Coating.
  - a. Prime coat:
    - 1) P1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
4. SYSTEM #41 - Touch-up of galvanized surfaces not requiring a top coat.
  - a. Refer to Specification Section 05 50 00.

## **PART 3 - EXECUTION**

### **3.1 ITEMS TO BE PAINTED**

- A. General:
  1. Paint the following surfaces in a corrosive or highly corrosive area, whether exposed to view or not:
    - a. Concrete and/or concrete masonry units.
    - b. Conduit.
    - c. Ducts.
    - d. Galvanized metal surfaces.
- B. Exposed Exterior Surfaces including:
  1. Piping, valves, fittings, and hydrants (except when covered by pipe jacketing) and supports. Field paint valves to match color of piping.
  2. Ductwork and supports.
  3. Conduit, device boxes, junction boxes and covers, pull boxes and covers and supports when attached to a surface required to be painted or to a prefinished surface.
  4. Exterior and interior surfaces of ferrous metal tankage.
  5. Miscellaneous ferrous metal surfaces.
  6. Steel joists (including bridging).
  7. Copper and brass surfaces.
  8. External and internal surfaces of digester covers whether sealed from direct exposure of outside atmosphere or digester atmosphere or not, and associated equipment.
    - a. Internal surfaces include trusses and other inside surfaces.
  9. Gas appliance flue vents and cast iron pipe plumbing vents.
- C. Surfaces in Areas Not Considered Finished:
  1. Paint following surfaces in areas not considered as finished area:
    - a. Piping, valves, fittings, and hydrants except when covered by pipe jacketing and supports.
    - b. Miscellaneous ferrous metal surfaces.
    - c. Steel lintels.

- d. Steel components of concrete lintels (plain or galvanized).
  - 1) Steel components shall be completely painted (with both prime and finish coats) prior to installing in the wall.
- e. Inside and outside of ferrous metal tankage.
- f. Hollow metal doors and frames and borrowed lite window frames.

### 3.2 ITEMS NOT TO BE PAINTED

- A. General: Do not paint items listed in this Article unless specifically noted in the Contract Documents to be painted.
- B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.
- C. Electrical Equipment:
  - 1. Do not field paint electrical equipment except where painting is specifically stated elsewhere in these Contract Documents, or where the equipment is subject to a corrosive environment and is specifically noted to be painted.
- D. Other Items:
  - 1. Stainless steel surfaces except:
    - a. Piping where specifically noted to be painted.
    - b. Banding as required to identify piping.
  - 2. Aluminum surfaces except:
    - a. Where specifically shown in the Contract Documents.
    - b. Where in contact with concrete.
    - c. Where in contact with dissimilar metals.
  - 3. Fiberglass surfaces except:
    - a. Fiberglass piping where specifically noted to be painted.
    - b. Piping supports where specifically noted to be painted.
  - 4. Interior of pipe, ductwork, and conduits.
  - 5. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.
  - 6. Code labels and equipment identification and rating plates.
  - 7. Concealed surfaces of precolored masonry.
  - 8. Structural steel or steel deck required to be fireproofed.
  - 9. Clad aluminum, clad steel, anodized aluminum, PVDF coated aluminum and PVDF coated steel.
  - 10. Prefinished wood doors. Prefinished wood trim.
    - a. Provide touch-up painting to damaged areas of prefinished surfaces.
  - 11. Steel deck, unless specifically noted to be painted in these Contract Documents.
  - 12. Standing seam metal roof, fascia, trim, and roof accessories.
  - 13. Contact surfaces of friction-type connections.
  - 14. Metal soffit.
  - 15. Galvanized steel items, unless specifically noted to be painted.
  - 16. Bituminous coated ductile iron pipe.
    - a. See the ITEMS TO BE PAINTED Article, Interior Finished Areas paragraph of this Specification Section.

### 3.3 SCHEDULE OF ITEMS TO BE PAINTED AND PAINTING SYSTEMS

- A. Galvanized Metals:
  - 1. Field touch-up where top coat is required: SYSTEM #3, prime and first finish coat only.
    - a. Prime paint only the damaged area.
  - 2. Assembled galvanized steel items: SYSTEM #3.
  - 3. Field touch-up of galvanized surfaces not requiring a finish top coat: SYSTEM #41.
    - a. Paint only damaged areas.

- B. Plastic Surfaces:
  - 1. PVC, FRP, and CPVC surfaces: SYSTEM #3.
    - a. Includes tankage and piping.
- C. Electrical Conduit:
  - 1. Galvanized: SYSTEM #3.
  - 2. PVC coated: SYSTEM #3.
- D. Pipe, Valves, and Fittings:
  - 1. Steel, cast-iron, and uncoated ductile iron not in immersion service: SYSTEM #2.
- E. Aluminum buried in concrete, between dissimilar metals and dissimilar materials: SYSTEM #19.

### 3.4 PREPARATION

- A. General:
  - 1. Verify that atmosphere in area where painting is to take place is within paint manufacturer's acceptable temperature, humidity and sun exposure limits.
    - a. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.
      - 1) Provide temporary dehumidification equipment properly sized to maintain humidity levels required by paint manufacturer.
      - 2) Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.
        - a) Vent exhaust gases to exterior environment.
        - b) No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.
  - 2. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
    - a. Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.
  - 3. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.
  - 4. Adhere to manufacturer's recoat time surface preparation requirements.
    - a. Surfaces that have exceeded coating manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations.
      - 1) Minimum SSPC SP 7/NACE No. 4 unless otherwise approved by Engineer.
- B. Protection:
  - 1. Protect surrounding surfaces not to be coated.
  - 2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
- C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.
- D. Wood:
  - 1. Sandpaper smooth, then dust.
  - 2. Seal all knots, pitch and resinous sapwood after priming coat has dried.
  - 3. Putty nail holes and minor defects to match wood color.
- E. Ferrous Metal:
  - 1. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAF.
    - a. All piping, pumps, valves, fittings and any other component used in any water piping system that requires preparation for painting shall be prepared in accordance with requirements for immersion service.

- 1) Pipe: NAPF 500-03-04.
  - 2) Fittings: NAPF 500-03-05
  - b. Prepare all areas requiring patch painting in accordance with recommendations of manufacturer and NAPF.
  - c. Remove bituminous coating per piping manufacturer, paint manufacturer and NAPF recommendations.
    - 1) The most stringent recommendations shall apply.
  2. Complete fabrication, welding or burning before beginning surface preparation.
    - a. Chip or grind off flux, spatter, slag or other laminations left from welding.
    - b. Remove mill scale.
    - c. Grind smooth rough welds and other sharp projections.
  3. Solvent clean in accordance with SSPC SP 1 or detergent and low-pressure water clean in accordance with SSPC SP 12/NACE No. 5 all surfaces scheduled to receive additional SSPC surface preparation.
  4. Surfaces subject to corrosive or highly corrosive environment and all surfaces subject to immersion service:
    - a. Near-white blast clean in accordance with SSPC SP 10/NACE No. 2.
  5. All interior and exterior structural steel not included in corrosive, highly corrosive or immersion service surfaces:
    - a. Minimum commercial blast clean in accordance with SSPC SP 6/NACE No. 3.
  6. Surfaces subject to high temperatures.
    - a. Heat in excess of 600 DegF: SSPC SP 10/NACE No. 2.
    - b. Heat in excess of 200 DegF but less than 600 DegF: SSPC SP 6/NACE No. 3.
  7. Surfaces of steel joists and steel trusses:
    - a. Commercial blast clean the major portion of the truss in accordance with SSPC SP 6/NACE No. 3.
    - b. Power tool or hand tool clean tight connection areas and other difficult to access areas in accordance with SSPC SP 2 or SSPC SP 3.
  8. Steel surfaces scheduled to receive SYSTEM #24 or #35:
    - a. White metal blast clean in accordance with SSPC SP 5/NACE No. 1.
    - b. Provide 2-1/2 to 3 mil anchor profile for SYSTEMS #24 and #35.
  9. All fusion bonded epoxy coated surfaces identified to be field painted:
    - a. Remove all traces of gloss finish by sanding or by abrasive brush blasting.
    - b. Clean surface after removing gloss finish to remove sanding or blasting residue.
  10. Restore surface of field welds and adjacent areas to original surface preparation.
  11. Black iron piping: Remove surface varnish by solvent or waterjet and detergent cleaning or brush-off blast cleaning in accordance with SSPC SP 7/NACE No. 4.
- F. Hollow Metal:
1. Clean in accordance with SSPC SP 1 or SSPC SP 12/NACE No. 5 and in accordance with hollow metal manufacturer.
- G. Galvanized Steel and Non-ferrous Metals:
1. Solvent clean in accordance with SSPC SP 1 followed by brush-off blast clean in accordance with SSPC SP 16 to remove zinc oxide and other foreign contaminants.
    - a. Provide uniform 1 mil profile surface.
- H. Abrasive blast clean the following equipment or surfaces regardless of previous finish, if any.
- I. Concrete:
1. Cure for minimum of 28 days.
  2. Verify that concrete surfaces have been cleaned and that voids have been patched in accordance with Specification Section 03 31 32.
    - a. Concrete surfaces shall be cleaned in accordance with ASTM D4258.
  3. Mechanically abrade concrete surfaces in accordance with ASTM D4259 as recommended by coating manufacturer.

4. Abrasive blast concrete surfaces in accordance with SSPC SP 13/NACE No. 6 to provide profile recommended by coatings manufacturer.
  5. Test pH of surface to be painted in accordance with ASTM D4262.
    - a. If surface pH is not within coating manufacturer's required acceptable range, use methods acceptable to coating manufacturer as required to bring pH within acceptable range.
    - b. Retest pH until acceptable results are obtained.
  6. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
    - a. Test moisture content of surface to be coated in accordance with ASTM D4263.
    - b. After remedial measures have been taken to lower or raise moisture content, retest surface until acceptable results are obtained.
- J. Preparation by Abrasive Blasting:
1. All abrasive-blasted ferrous metal surfaces shall be inspected and approved in writing by NACE certified coatings inspector immediately prior to application of paint coatings.
    - a. Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with these Specifications.
  2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
  3. Perform additional blasting and cleaning as required to achieve surface preparation required.
    - a. Prior to painting, reblast surfaces allowed to set overnight and surfaces that show rust bloom.
    - b. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be reinspected and approved by NACE certified coatings inspector prior to paint application.
  4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless required otherwise by coating manufacturer.
  5. Provide compressed air for blasting that is free of water and oil.
    - a. Provide accessible separators and traps.
  6. Confine blast abrasives to area being blasted.
    - a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
    - b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.
  7. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.
  8. Reblast surfaces not meeting requirements of these Specifications.
  9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.
  10. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.
- K. All Plastic Surfaces and Non-Ferrous Surfaces Except Galvanized Steel:
1. Sand using 80-100 grit sandpaper to scarify surfaces.

### 3.5 APPLICATION

- A. General:
1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.
    - a. Application equipment must be inspected and approved in writing by coating manufacturer.
    - b. Hollow metal shall be spray applied only.
  2. Temperature and weather conditions:

- a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
  - b. Avoid painting surfaces exposed to hot sun.
  - c. Do not paint on damp surfaces.
  3. Immediately after surface has been inspected and accepted by NACE certified coatings inspector, apply structural steel and miscellaneous steel and steel joist and steel truss prime coat in the factory.
    - a. Finish coats shall be applied in the field factory.
    - b. Prime coat referred to here is prime coat as indicated in this Specification.
      - 1) Structural steel and miscellaneous steel and steel joist and steel truss prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.
  4. Provide complete coverage to mil thickness specified.
    - a. Thickness specified is dry mil thickness.
    - b. All paint systems are "to cover."
      - 1) In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
    - c. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
  5. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
  6. Apply materials under adequate illumination.
  7. Evenly spread to provide full, smooth coverage.
  8. Work each application of material into corners, crevices, joints, and other difficult to work areas.
  9. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.
    - a. Clean contaminated surfaces before applying next coat.
  10. Smooth out runs or sags immediately, or remove and recoat entire surface.
  11. Allow preceding coats to dry before recoating.
    - a. Recoat within time limits specified by coating manufacturer.
    - b. If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.
  12. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
  13. Coat all aluminum in contact with dissimilar materials.
  14. When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses.
  15. Backroll concrete and masonry and gypsum board and plaster and abuse resistant panel and wood surfaces with a roller if paint coatings are spray applied.
- B. Prime Coat Application:
1. Prime all surfaces indicated to be painted.
    - a. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Specification Section.
  2. Ensure field-applied coatings are compatible with factory-applied coatings.
    - a. Ensure new coatings applied over existing coatings are compatible.
    - b. Employ services of coating manufacturer's qualified technical representative.
      - 1) Certify through material data sheets.
      - 2) Perform test patch.
    - c. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
    - d. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.

- 1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.
  3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
  4. Back prime all wood scheduled to be painted, prior to installation.
  5. After application of primer to gypsum board surfaces, inspect surface and repair in accordance with the PREPARATION Article of this Specification Section.
    - a. Re-prime repaired surfaces to uniform finish before application of finish coat(s).
  6. Apply zinc-rich primers while under continuous agitation.
  7. Ensure abrasive blasting operation does not result in embedment of abrasive particles in paint film.
  8. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
  9. Touch up damaged primer coats prior to applying finish coats.
    - a. Restore primed surface equal to surface before damage.
  10. All surfaces of steel lintels and steel components of concrete lintels used in wall construction shall be completely painted with both prime and finish coats prior to placing in wall.
- C. Finish Coat Application:
1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section; manufacturer instructions take precedent over these Specifications.
  2. Touch up damaged finish coats using same application method and same material specified for finish coat.
    - a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

### 3.6 COLOR CODING

- A. Color and band piping in accordance with the SCHEDULE Article of this Specification Section.
1. Band piping using maximum of three (3) different colors at 20 FT maximum centers.
  2. Factory painted piping shall be color banded in the factory per the Schedule in the SCHEDULE Article of this Specification Section.
  3. Place bands:
    - a. Along continuous lines.
    - b. At changes in direction.
    - c. At changes of elevation.
    - d. On both sides of an obstruction (e.g., wall, ceiling) that painted item passes through.
  4. Band width for individual colors (pipe diameter measured to outside of insulation, if applicable):
    - a. Piping up to 8 IN DIA: 2 IN minimum.
    - b. Piping greater than 8 IN up to 24 IN DIA: 4 IN minimum.
    - c. Piping greater than 24 IN up to 48 IN DIA: 6 IN minimum.
    - d. Piping greater than 48 IN DIA: 8 IN minimum.

### 3.7 FIELD QUALITY CONTROL

- A. Contractor to provide protection for surfaces painted with epoxy coatings to prevent chalking.
1. Surfaces showing chalking will not be accepted regardless of condition of paint film.
- B. Maintain Daily Records:
1. Record the following information during application of each coat of paint applied:
    - a. Date, starting time, end time, and all breaks taken by painters.
    - b. For exterior painting:
      - 1) Sky condition.
      - 2) Wind speed and direction.
    - c. Air temperature.

- 1 d. Relative humidity.
- 2 e. Moisture content and surface temperature of substrate prior to each coat.
- 3 f. Provisions utilized to maintain work area within manufacturer's recommended
- 4 application parameters including temporary heating, ventilation, cooling,
- 5 dehumidification and provisions utilized to mitigate wind blown dust and debris from
- 6 contaminating the wet paint film.
- 7 g. Record environmental conditions, substrate moisture content and surface temperature
- 8 information not less than once every four (4) hours during application.
- 9 1) Record hourly when temperatures are below 50 DegF or above 100 DegF.
- 10 2. Record the following information daily for the paint manufacturer's recommended curing
- 11 period:
- 12 a. Date and start time of cure period for each item or area.
- 13 b. For exterior painting:
- 14 1) Sky conditions.
- 15 2) Wind speed and direction.
- 16 c. Record environmental conditions not less than once every 12 hours.
- 17 1) Record once every four (4) hours when ambient temperature is below 35 DegF.
- 18 d. Provisions utilized to protect each item or area and to maintain areas within
- 19 manufacturer's recommended curing parameters.
- 20 3. Format for daily record to be computer generated.
- 21 C. Measure wet coating with wet film thickness gages.
- 22 D. Measure coating dry film thickness in accordance with SSPC PA 2 using Mikrotest gage
- 23 calibrated against NBS "Certified Coating Thickness Calibration Standards."
- 24 1. Engineer may measure coating thickness at any time during project to assure conformance
- 25 with these Specifications.
- 26 E. Measure surface temperature of items to be painted with surface temperature gage specifically
- 27 designed for such.
- 28 F. Measure substrate humidity with humidity gage specifically designed for such.
- 29 G. Provide wet paint signs.

### 3.8 CLEANING

- 31 A. Clean paint spattered surfaces.
- 32 1. Use care not to damage finished surfaces.
- 33 B. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.
- 34 C. Remove surplus materials, scaffolding, and debris.

### 3.9 SCHEDULE

- 36 A. Piping and Pipe Banding Color Schedule (Colors based on Tnemec):
- 37 1. Match existing piping and banding colors or color selections by Owner.

**END OF SECTION**

**SECTION 09 56 52**  
**CONCRETE PROTECTIVE COATINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Epoxy corrosion-resistant lining system.
- B. All concrete surfaces noted in 3.4 shall be coated by epoxy system. A combination of systems will not be allowed.
- C. Related Sections include but are not necessarily limited to:
  - 1. Division 1 - General Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
    - b. D4259, Standard Practice for Abrading Concrete.
    - c. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surface.
    - d. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
  - 2. National Association of corrosion Engineers (NACE).
    - a. Standard Recommended Practice, Discontinuity (Holiday) Testing of Protective coatings.
- B. Qualifications:
  - 1. Applicator to be licensed or approved, in writing, by manufacturer.
  - 2. Applicator to have successfully completed minimum of three projects in last 5 years with the paint system to be used.
  - 3. Provide references for minimum of five projects in last 5 years including type of installation, paint system used, square footage of material installed and name and telephone number of client contact.
  - 4. NACE inspector shall be NACE certified coatings inspector and shall have minimum of 5 years experience conducting tests as indicated in this Specification.
- C. Mock-Ups:
  - 1. Construct mock-up area minimum 4 x 4 FT utilizing all specified or required components for Engineer review and acceptance.
  - 2. Area shall constitute minimum standard of quality for actual construction. Maintain area during construction.
  - 3. If not acceptable, construct additional areas as required.
  - 4. Remove when directed by Engineer.
  - 5. Area shall not be built into permanent construction.
  - 6. Mock-up shall include all corners, coves, bases and other special detailing as required by Project conditions.
    - a. Mock-up surface shall have same finish as finish to be expected in the actual work.
    - b. Mock-up substrate surface moisture content shall be same as moisture content to be expected in actual work.
- D. Miscellaneous:
  - 1. Furnish paint through one manufacturer unless noted otherwise.

- E. Deviations from specified mil thickness or product type not allowed without written authorization of Engineer.

### 1.3 DEFINITIONS

- A. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.
1. Installer or applicator are synonymous.
- B. Defective: Coating will be considered defective if, in the opinion of the Engineer, any of the following conditions exist in the final product:
1. Dry film thicknesses have not been met.
  2. Debris is embedded in material.
  3. Surface exhibits any defect identified in paragraph 3.02C and D.
  4. Loss of adhesion.
  5. Discoloration.
- C. Holiday: A void, crack, thin spot, foreign inclusion, or contamination in the coating film that significantly lowers the dielectric strength of the coating, may also be identified as a holiday or pinhole.

### 1.4 SYSTEM DESCRIPTION

- A. Coating must be capable of withstanding continuous immersion in the following chemicals:
1. Wastewater.

### 1.5 SUBMITTALS

- A. Shop Drawings:
1. See Section 01 33 00.
  2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's surface preparation and application instructions.
    - c. Complete physical and chemical characteristics.
    - d. Chemical-resistance information.
    - e. Manufacturer's recommendations for adhesives, primer, and miscellaneous materials used.
    - f. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
- B. Miscellaneous Submittals:
1. Manufacturer's statement regarding Applicator instruction on product use.
  2. Applicator's qualifications and references, including:
    - a. Certification of approved applicator status from the manufacturer.
    - b. Certification that the applicator's field personnel have at least 3 years of field technical support experience with the coating.
  3. Warranty.
  4. Written certification that coating has been applied properly.
  5. Daily record.
  6. Surface preparation approval by NACE engineer.
  7. Paint application certification by NACE engineer.
  8. Letter of intent from coating manufacturer that they will provide a warranty meeting the requirements of paragraph 1.07.
- C. Operation and Maintenance Manuals:
1. See Section 01 33 00.
  2. Provide detailed procedures for light repairs such as scratches, dents and staining and for routine maintenance and cleaning.

D. Results of discontinuity testing indicating any corrective action taken.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

A. Deliver in original containers, labeled as follows:

1. Name or type, number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels
5. VOC content.

B. Store paint materials at minimum ambient temperature of 45 DegF and a maximum of 90 DegF in ventilated area.

## **1.7 WARRANTY**

A. Coating manufacturer shall provide written 5-year warranty covering defects in material.

B. Applicator shall provide written 5-year installation warranty covering defects in workmanship.

1. Warrant Coating Against:
  - a. Delamination from substrate.
  - b. Degradation of finish.
  - c. Cracking and spalling.
  - d. Corrosion of substrate due to defects in finish

# **PART 2 - PRODUCTS**

## **2.1 ACCEPTABLE MANUFACTURERS**

A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable:

1. Epoxy corrosion-resistant lining system:
  - a. Raven Lining System - Raven 405.

B. Submit requests for substitution in accordance with Specification Section 01 25 13.

## **2.2 MATERIALS**

A. General:

1. All materials used must contain not more than 2.8 lbs/Gal VOC as applied (in thinned state) unless noted otherwise.
2. For unspecified materials such as thinner, provide manufacturer's recommended products.
3. Paint Systems – General:
  - a. P-prime coat. F1, F2 ... Fn=first finish coat, second finish coat .... Nth finish coat, color as selected by Engineer.
  - b. If two finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one coat equal to mil thickness of two coats specified.
4. Any one of the two systems specified below may be selected. However, only one system may be used. A combination of systems will not be allowed.
5. Total coating thickness: 120 mils minimum or as required to obtain a pinhole free lining, whichever is greater.

B. Epoxy Corrosion-Resistant Lining:

1. Solids by volume: 100 percent
2. Color: to be issued during construction.
3. Sprayable, high solids, high build epoxy
4. "Raven" System by Raven Lining Systems.

- a. Prime Coat
  - 1) P1 = 1 coat, 3 to 5 mils, Aquapoxy A10 (neat epoxy resin), VOC = 0.00.
- b. Finish Coat
  - 1) F1 = 2 coats, 60 mils each (120 mils total), Raven 405 (epoxy), VOC = 0.00.

## 2.3 ACCESSORIES

- A. Provide all primers, crack filler, sealants, thinners, etc., as required and as recommended by the coating manufacturer.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. All cleaning, surface preparation, and application shall be performed by a contractor certified by the manufacturer and experienced in application of the specific product to be used.
- B. Verify suitability of substrate to accept installation.
  - 1. Prepare substrate in accordance with manufacturer's written instructions.
  - 2. Remove all dust, grease, oil, compounds, dirt, old paint and other foreign matter which would prevent bonding of coating to surface.
  - 3. Cure concrete in accordance with coating manufacturer's recommendations.
  - 4. Fill and seal porous concrete and/or pits and voids in the concrete surfaces as recommended by manufacturer.
  - 5. Grind all welds as recommended by manufacturer.
  - 6. Remove spent blasting material and dust by vacuuming.
  - 7. Protect surrounding surfaces, not to be coated.
- C. New Concrete:
  - 1. Cure for minimum of 28 days.
  - 2. Verify that concrete surfaces have been cleaned and that voids have been patched in accordance with Section 03002.
    - a. Concrete surfaces shall be cleaned in accordance with ASTM D4258.
  - 3. Test pH of surface to be painted in accordance with ASTM D4262.
    - a. If surface pH is not within coating manufacturer's required acceptable range, flush surface with clean water as required to bring pH within acceptable limits.
    - b. Retest pH until acceptable results are obtained.
  - 4. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
    - a. Test moisture content of surface to be coated in accordance with ASTM D4263.
    - b. After remedial measures have been taken to lower or raise moisture content, retest surface until acceptable range is obtained.
  - 5. Mechanically abrade and resurface concrete surfaces in accordance with ASTM D4259 as recommended by coating manufacturer.
- D. Existing Concrete:
  - 1. Remove existing lining by Abrasive Blasting.
  - 2. High pressure water wash surfaces to be recoated.
    - a. Minimum water pressure: 5,000 psi.
    - b. Pressure wash shall conform to 1995 SSPC-SP 12.
    - c. Surfaces shall be washed to a WJ-2 condition as specified in SSPC-SP 12.
    - d. Prior to coating application, verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
      - 1) Test moisture content of surface to be coated in accordance with ASTM D4263.
    - e. Provide ventilation of space during cleaning and testing of concrete surfaces.
  - 3. Repair surface defects in accordance with Section 03002.

- E. Abrasive Blast Clean existing concrete surfaces regardless of previous finish, if any:
1. All abrasive-blasted surfaces shall be inspected immediately prior to application of paint coatings.
    - a. Inspection shall be performed to determine profile depth of blasted surfaces and cleanliness and to certify that surface has been prepared in accordance with these Specifications.
  2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
  3. Perform additional blasting and cleaning as required to achieve surface preparation required. Prior to painting, reblast surfaces allowed to set overnight or surfaces that show rust bloom.
    - a. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be reinspected by coating manufacturer prior to paint application.
  4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless noted otherwise by coating manufacturer.
  5. Provide compressed air for blasting that is free of water and oil. Provide accessible separators and traps.
  6. Confine blast abrasives to area being blasted.
    - a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
    - b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.
  7. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.
  8. Reblast surfaces not meeting requirements of these Specifications.
  9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.
  10. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.

### 3.2 APPLICATION

- A. Application of material indicates acceptance of the substrate.
- B. NACE certified coatings inspector will inspect and approve the following:
1. Surface preparation prior to application of prime coat.
  2. Prime coat prior to application of finish coat.
- C. Apply primer and finish coats in accordance with manufacturer's recommendations.
1. Apply primer in single coat to thickness recommended by manufacturer.
  2. Apply finish material to the mil dry thickness specified in 2.2.
- D. Finished surface shall be free of pinholes and holidays.
- E. Finished surface shall also be smooth and uniform, free of runs, sags, waves, depressions, ridges, honeycombing and other imperfections.
- F. Maintain minimum temperatures before, during, and after coating application to assure proper curing.
- G. Test wet mil thickness as recommended by manufacturer to provide uniform accurate coverages.

### 3.3 FIELD QUALITY CONTROL

- A. The manufacturer's representative shall provide services of manufacturer's authorized representative during coating application, substrate preparation and after all coating work is completed.
1. Certify that surface has been prepared in accordance with coating manufacturer's recommendations.
  2. Certify that substrate moisture content is within manufacturer's acceptable limits.

3. Certify that ambient temperature and temperature of substrate to be coated are within manufacturer's acceptable limits.
  4. Certify that coating has been properly applied to required mil thickness.
- B. Maintain daily record of substrate temperature, substrate moisture content, ambient air temperature, humidity and wind conditions. Daily record shall be authenticated by manufacturer's authorized representative.
1. Daily record shall be accessible to Engineer anytime during normal project work hours.
  2. Provide certified copy of daily record to Owner as part of project close-out documents.
- C. Certify that coated surfaces have been tested in accordance with NACE specifications for bare areas, pinholes, and holidays with a non-destructive holiday detector. High voltage spark testing shall be performed by the Contractor witnessed by Owner's representative to demonstrate a pinhole free (spark free) lining. The voltage used shall be a minimum of 100 volts per mil. A known "void" shall serve to verify proper operation of the spark testing equipment. If necessary a void will be created for the purposes of ensuring proper adjustment of the equipment. The Engineers/Owner may have a coating inspector to test separately for holidays as well.
- D. Areas exhibiting excessive sags, runs or drips may be ground down flush with the lining at the discretion of the Engineer/Owner.
- E. Repair all defective coating in accordance with manufacturer's printed recommendations.
- F. Durometer readings shall be within those stated by the latest manufacturers published data sheets.
- G. TDFT (Total Dry Film Thickness) readings shall measure as equal to or greater than the minimum specified. Concrete substrates shall have core samples taken per the manufacturer's recommendations.
- H. Upon completion of the protective coating system installation, the surface of the coating shall be cleaned in order to permit inspection by the Engineer's/Owner's coating inspector.
- I. Inspection procedures shall follow NACE and SSPC procedures as appropriate.
- J. Application of material indicates acceptance of the substrate by the contractor and the coating manufacturer's authorized representative.
- K. All coating systems shall be properly cured prior to returning the coated area to service. Cure time shall be as recommended by the coating manufacturer.
- L. Provide discontinuity testing of all surfaces in accordance with NACE requirements. Contractor shall schedule with Owner's representative to witness discontinuity testing.
1. Repair all "Holidays" using same material as original coating being tested within recommended recoat time.
  2. Retest and recoat as required until area passes test criterion.
- M. Provide non-skid surface on all horizontal surfaces.

### **3.4 CONCRETE SURFACES TO BE COATED**

- A. Existing sanitary sewer manholes.

**END OF SECTION**

**SECTION 10 14 00**  
**IDENTIFICATION DEVICES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and similar items, and hazard and safety signs.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

**1.2 QUALITY ASSURANCE**

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
  - a. A13.1, Scheme for the Identification of Piping Systems.
2. Instrumentation, Systems, and Automation Society (ISA).
3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
  - a. Z535.1, Safety Color Code.
  - b. Z535.2, Environmental and Facility Safety Signs.
  - c. Z535.3, Criteria for Safety Symbols.
  - d. Z535.4, Product Safety Signs and Labels.
4. National Fire Protection Association (NFPA):
  - a. 70, National Electrical Code (NEC).
5. Occupational Safety and Health Administration (OSHA):
  - a. 29 CFR 1910.145, Specification for Accident Prevention Signs and Tags.

**1.3 SUBMITTALS**

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
  - a. Catalog information for all identification systems.
  - b. Acknowledgement that products submitted meet requirements of standards referenced.
3. Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and color.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. W.H. Brady Co.
2. Panduit.
3. Seton.
4. National Band and Tag Co.
5. Carlton Industries, Inc.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

## 2.2 MANUFACTURED UNITS

### A. Type A1 - Round Metal Tags:

1. Materials:
  - a. Aluminum or stainless steel.
  - b. Stainless steel shall be used in corrosive environments.
2. Size:
  - a. Diameter: 1-1/2 IN minimum.
  - b. Thickness: 0.035 IN (20 GA) minimum.
3. Fabrication:
  - a. 3/16 IN minimum mounting hole.
  - b. Legend: Stamped and filled with black coloring.
4. Color: Natural.

### B. Type A2 - Rectangle Metal Tags:

1. Materials: Stainless steel.
2. Size:
  - a. 3-1/2 IN x 1-1/2 IN minimum.
  - b. Thickness: 0.036 IN (20 GA) minimum.
3. Fabrication:
  - a. 3/16 IN minimum mounting hole.
  - b. Legend: Stamped and filled with black coloring.
4. Color: Natural.

### C. Type B1- Square Nonmetallic Tags:

1. Materials: Fiberglass reinforced plastic.
2. Size:
  - a. Surface: 2 x 2 IN minimum.
  - b. Thickness: 100 mils.
3. Fabrication:
  - a. 3/16 IN mounting hole with metal eyelet.
  - b. Legend: Preprinted and permanently embedded and fade resistant.
4. Color:
  - a. Background: Manufacturer standard or as specified.
  - b. Lettering: Black.

### D. Type B2 - Nonmetallic Signs:

1. Materials: Fiberglass reinforced or durable plastic.
2. Size:
  - a. Surface: As required by text.
  - b. Thickness: 60 mils minimum.
3. Fabrication:
  - a. Rounded corners.
  - b. Drilled holes in corners with grommets.
  - c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.
4. Color:
  - a. Background: Manufacturer standard or as specified.
  - b. Lettering: Black.
5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

### E. Type C - Laminated Name Plates:

1. Materials: Phenolic or DR (high impact) acrylic.
2. Size:
  - a. Surface: As required by text.

- 1 b. Thickness: 1/16 IN.
- 2 3. Fabrication:
- 3 a. Outdoor rated and UV resistant when installed outdoors.
- 4 b. Two (2) layers laminated.
- 5 c. Legend: Engraved through top lamination into bottom lamination.
- 6 d. Two (2) drilled side holes, for screw mounting.
- 7 4. Color: Black top surface, white core, unless otherwise indicated.
- 8 F. Type D - Self-Adhesive Tape Tags and Signs:
- 9 1. Materials: Vinyl tape or vinyl cloth.
- 10 2. Size:
- 11 a. Surface: As required by text.
- 12 b. Thickness: 5 mils minimum.
- 13 3. Fabrication:
- 14 a. Indoor/Outdoor grade.
- 15 b. Weather and UV resistant inks.
- 16 c. Permanent adhesive.
- 17 d. Legend: Preprinted.
- 18 e. Wire markers to be self-laminating.
- 19 4. Color: White with black lettering or as specified.
- 20 5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI
- 21 Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.
- 22 G. Type F - Underground Warning Tape:
- 23 1. Materials: Polyethylene.
- 24 2. Size:
- 25 a. 6 IN wide (minimum).
- 26 b. Thickness: 3.5 mils.
- 27 3. Fabrication:
- 28 a. Legend: Preprinted and permanently imbedded.
- 29 b. Message continuous printed.
- 30 c. Tensile strength: 1750 psi.
- 31 4. Color: As specified.
- 32 H. Type G - Stenciling System:
- 33 1. Materials:
- 34 a. Exterior type stenciling enamel.
- 35 b. Either brushing grade or pressurized spray can form and grade.
- 36 2. Size: As required.
- 37 3. Fabrication:
- 38 a. Legend: As required.
- 39 4. Color: Black or white for best contrast.
- 40 I. Underground Tracer Wire:
- 41 1. Materials:
- 42 a. Wire:
- 43 1) 12 GA AWG.
- 44 2) Solid.
- 45 b. Wire nuts: Waterproof type.
- 46 c. Split bolts: Brass.

## 2.3 ACCESSORIES

- 48 A. Fasteners:
- 49 1. Bead chain: #6 brass, aluminum or stainless steel.
- 50 2. Plastic strap: Nylon, urethane or polypropylene.
- 51 3. Screws: Self-tapping, stainless steel.
- 52 4. Adhesive, solvent activated.

## 2.4 MAINTENANCE MATERIALS

- A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION

- A. Install identification devices at specified locations.
- B. All identification devices to be printed by mechanical process, hand printing is not acceptable.
- C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.
- D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
  - 1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.
- E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
  - 1. Several items of equipment mounted in housing to be individually tagged inside the compartment.
- F. Tracer Wire:
  - 1. Attach to pipe at a maximum of 10 FT intervals with tape or tie-wraps.
  - 2. Continuous pass from each valve box and above grade at each structure.
  - 3. Coil enough wire at each valve box to extend wire a foot above the ground surface.
  - 4. 1,000 FT maximum spacing between valve boxes.
  - 5. If split bolts are used for splicing, wrap with electrical tape.
  - 6. If wire nuts are used for splicing, knot wire at each splice point leaving 6 IN of wire for splicing.
  - 7. Use continuous strand of wire between valve box where possible.
    - a. Continuous length shall be no shorter than 100 FT.

### 3.2 SCHEDULES

- A. Process Systems:
  - 1. General:
    - a. Provide arrows and markers on piping.
      - 1) At 20 FT maximum centers along continuous lines.
      - 2) At changes in direction (route) or obstructions.
      - 3) At valves, risers, "T" joints, machinery or equipment.
      - 4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
    - b. Position markers on both sides of pipe with arrow markers pointing in flow direction.
      - 1) If flow is in both directions use double headed arrow markers.
    - c. Apply tapes and stenciling in uniform manner parallel to piping.
  - 2. Trenches with piping:
    - a. Tag type: Type F - Underground Warning Tape
    - b. Location: Halfway between top of piping and finished grade.
    - c. Letter height: 1-1/4 IN minimum.
    - d. Natural gas or digester gas:
      - 1) Color: Yellow with black letters.
    - 2) Legend:
      - a) First line: "CAUTION CAUTION CAUTION"
      - b) Second line: "BURIED GAS LINE BELOW"

- e. Potable water:
  - 1) Color: Blue with black letters.
  - 2) Legend:
    - a) First line: "CAUTION CAUTION CAUTION"
    - b) Second line: "BURIED WATER LINE BELOW"
- f. Storm and sanitary sewer lines:
  - 1) Color: Green with black letters.
  - 2) Legend:
    - a) First line: "CAUTION CAUTION CAUTION"
    - b) Second line: "BURIED SEWER LINE BELOW"
- g. (Nonpotable) water piping, except 3 IN and smaller irrigation pipe:
  - 1) Color: Green with black letters.
  - 2) Legend:
    - a) First line: "CAUTION CAUTION CAUTION"
    - b) Second line: "BURIED NONPOTABLE WATER LINE BELOW"
- h. Chemical feed piping (e.g., chlorine solution, polymer solution, caustic solution, etc.):
  - 1) Color: Yellow with black letters.
  - 2) Legend:
    - a) First line: "CAUTION CAUTION CAUTION"
    - b) Second line: "BURIED CHEMICAL LINE BELOW"
- i. Other piping (e.g., compressed air, irrigation, refrigerant, heating water, etc.):
  - 1) Color: Yellow with black letters.
  - 2) Legend:
    - a) First line: "CAUTION CAUTION CAUTION"
    - b) Second line: "BURIED PIPE LINE BELOW"
3. Yard valves, buried, with valve box and concrete pad:
  - a. Tag type: Type A2 - Rectangle Metal Tags.
  - b. Fastener: 3/16 IN x 7/8 IN plastic screw anchor with 1 IN #6 stainless steel pan head screw.
  - c. Legend:
    - 1) Letter height: 1/4 IN minimum.
    - 2) Valve designation as indicated on the Drawings (e.g., "V-xxx").
4. Valves and slide gates:
  - a. Tag type:
    - 1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
  - b. Fastener:
    - 1) Type B1: Stainless steel chain.
  - c. Color: Per ASME A13.1 corresponding to the piping system.
  - d. Legend:
    - 1) Letter height: 1/4 IN minimum.
    - 2) Valve designation as indicated on the Drawings (e.g., "V-xxx").
5. Process equipment (e.g., pumps, pump motors, blowers, air compressors, bar screens, clarifier drive mechanism, etc.):
  - a. Tag type:
    - 1) Type B2 - Nonmetallic Signs.
    - 2) Type D - Self-Adhesive Tape Tags and Signs.
    - 3) Type G - Stenciling System.
  - b. Fastener:
    - 1) Self.
    - 2) Screws.
    - 3) Adhesive.
  - c. Legend:
    - 1) Letter height: 1/2 IN minimum.
    - 2) Equipment designation as indicated on the Drawings (e.g., "Primary Sludge Pump P-xxx").
6. Piping systems:

- a. Tag type:
  - 1) Outdoor locations: Type G - Stenciling System.
  - 2) Indoor locations:
    - a) Type D - Self-Adhesive Tape Tags and Signs.
    - b) Type G - Stenciling System.
- b. Fastener: Self.
- c. Color: Per ASME A13.1.
- d. Legend:
  - 1) Letter height: Manufacturers standard for the pipe diameter.
  - 2) Mark piping in accordance with ASME A13.1.
  - 3) Use piping designation as indicated on the Drawings.
  - 4) Arrow: Single arrow.
7. Process tanks (over 1000 GAL) and basins, (e.g., chemical storage, clarifiers, trickling filters, digesters, etc):
  - a. Tag type:
    - 1) Type B2 - Nonmetallic Signs.
    - 2) Type G - Stenciling System.
  - b. Fastener:
    - 1) Screw.
    - 2) Self.
  - c. Location as directed by Owner.
  - d. Legend:
    - 1) Letter height: 4 IN minimum.
    - 2) Equipment designation as indicated on the Drawings (e.g., "Clarifier CL-xxx").
8. Tanks (less than 1000 GAL) (e.g., break tanks, chemical tanks, hydro-pneumatic tanks, air receivers, etc.):
  - a. Tag type:
    - 1) Type D - Self-Adhesive Tape Tags and Signs.
    - 2) Type G - Stenciling System.
  - b. Fastener: Self.
  - c. Legend:
    - 1) Letter height: 2 IN minimum.
    - 2) Equipment designation as indicated on the Drawings (e.g., "Polymer Storage Tank Txxx")
9. Equipment that starts automatically:
  - a. Tag type:
    - 1) Type B2 - Nonmetallic Signs.
    - 2) Type D - Self-Adhesive Tape Tags and Signs.
  - b. Fastener:
    - 1) Type B2 - Screw or adhesive.
    - 2) Type D - Self.
  - c. Size: 5 IN x 7 IN
  - d. Location: Pump P-01.
  - e. Legend:
    - 1) OSHA Warning Sign.
    - 2) Description of Warning: "THIS MACHINE STARTS AUTOMATICALLY".
- B. Instrumentation Systems:
  1. Instrumentation Equipment (e.g., flow control valves, primary elements, etc.):
    - a. Tag type:
      - 1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
    - b. Fastener:
      - 1) Type B1: Stainless steel chain.
    - c. Legend:
      - 1) Letter height: 1/4 IN minimum.
      - 2) Equipment ISA designation as indicated on the Drawings (e.g., "FIT-xxx").

2. Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):
    - a. Tag type: Type C - Phenolic Name Plates.
    - b. Fastener: Screws.
    - c. Legend:
      - 1) Letter height: 1/2 IN minimum.
      - 2) Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").
  3. Components inside equipment enclosure, (e.g., PLC's, control relays, contactors, and timers):
    - a. Tag type: Type D - Self-Adhesive Tape Tags.
    - b. Fastener: Self.
    - c. Legend:
      - 1) Letter height: 3/16 IN minimum.
      - 2) Description or function of component (e.g., "PLC-xxx" or "CR-xxx").
  4. Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):
    - a. Tag type: Type C - Phenolic Name Plates.
    - b. Fastener: Screws.
    - c. Legend:
      - 1) Letter height: 1/4 IN minimum.
      - 2) Component ISA tag number as indicated on the Drawings (e.g., "HS-xxx").
- C. Electrical Systems:
1. Trenches with ductbanks, direct-buried conduit, or direct-buried wire and cable.
    - a. Tag type: Type F - Underground Warning Tape.
    - b. Letter height: 1-1/4 IN minimum.
    - c. Location:
      - 1) Where trench is 12 IN or more below finished grade: In trench 6 IN below finished grade.
      - 2) Where trench is less than 12 IN below finished grade: In trench 3 IN below finished grade.
    - d. Electrical power (e.g., low and medium voltage):
      - 1) Color: Red with black letters.
      - 2) Legend:
        - a) First line: "CAUTION CAUTION CAUTION".
        - b) Second line: "BURIED ELECTRIC LINE BELOW".
    - e. Communications (e.g., telephone, instrumentation, LAN, SCADA):
      - 1) Color: Orange with black letters.
      - 2) Legend:
        - a) First line: "CAUTION CAUTION CAUTION".
        - b) Second line: "BURIED COMMUNICATION LINE BELOW".
  2. Panelboards and transformers:
    - a. Tag type: Type C - Phenolic Name Plates.
    - b. Fastener: Screws.
    - c. Legend:
      - 1) Letter height:
        - a) First line: 3/8 IN minimum.
        - b) Subsequent lines: 3/16 IN minimum.
      - 2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER Txxx").
      - 3) Second line (panelboards only): System voltage and phase (e.g., "208/120V, 3PH").
      - 4) Third line:
        - a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
        - b) Include the building name or number if the source is in another building.
  3. Safety switches, separately mounted circuit breakers and motor starters, VFD's, etc.:
    - a. Tag type: Type C - Phenolic Name Plates.

- b. Fastener: Screws.
- c. Legend:
  - 1) Letter height: 1/4 IN minimum.
  - 2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").
- 4. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
  - a. Tag type: Type C - Phenolic Name Plates.
  - b. Fastener: Screws.
  - c. Legend:
    - 1) Letter height: 1/2 IN minimum.
    - 2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").
- 5. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power transformers, control relays, contactors, timers, etc.):
  - a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
  - b. Fastener: Self.
  - c. Legend:
    - 1) Letter height: 3/16 IN minimum.
    - 2) Description or function of component (e.g., "M-xxx", "CR-xxx" or "TR-xxx").
- 6. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
  - a. Tag type: Type C - Phenolic Name Plates.
  - b. Fastener: Screws.
  - c. Legend:
    - 1) Letter height: 1/4 IN minimum.
    - 2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").
- 7. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
  - a. Tag type: Type D - Self-Adhesive Tape Tags.
  - b. Fastener: Self.
  - c. Tag conductor at both ends.
  - d. Legend:
    - 1) Letter height: 1/8 IN minimum.
    - 2) Circuit number or wire number as scheduled on the Drawings or as furnished with the equipment.
- 8. Grounding conductors associated with grounding electrode system in accordance with the following:
  - a. Tag type: Type D - Self-Adhesive Tape Tags.
  - b. Fastener: Self.
  - c. Legend:
    - 1) Letter height: 1/8 IN minimum.
    - 2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").
- 9. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
  - a. Tag type: Type D - Self-Adhesive Tape Signs.
  - b. Fastener: Self.
  - c. Legend: Per NFPA 70.
- 10. Equipment where more than one (1) voltage source is present:
  - a. Tag type:
    - 1) Type B2 - Nonmetallic Signs.
    - 2) Type D - Self-Adhesive Tape Signs.
  - b. Fastener:
    - 1) Screw or adhesive.
    - 2) Self.
  - c. Size: 1-3/4 IN x 2-1/2 IN.
  - d. Location: Exterior face of enclosure or cubical.
  - e. Legend:

- 1 1) OSHA Danger Sign.
- 2 2) Description of Danger: "MULTIPLE VOLTAGE SOURCES".

4 **END OF SECTION**



**SECTION 26 05 00**  
**ELECTRICAL: BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Basic requirements for electrical systems.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 10 14 00 - Identification Devices.
  - 4. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
  - 5. Section 26 05 33 - Raceways and Boxes.
  - 6. Section 40 05 05 - Equipment: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. Aluminum Association (AA).
  - 2. American Iron and Steel Institute (AISI).
  - 3. ETL Testing Laboratories (ETL).
  - 4. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. C2, National Electrical Safety Code (NESC).
  - 5. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
  - 6. Underwriters Laboratories, Inc. (UL).
- B. Where UL test procedures have been established for the product type, use UL or ETL approved electrical equipment and provide with the UL or ETL label.

**1.3 DEFINITIONS**

- A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
  - 1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
  - 2. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

**1.4 SYSTEM DESCRIPTION**

- A. Coordinate installation of the service transformer and metering with the serving utility.
  - 1. The serving utility for this Project is Public Service Company of New Mexico.

**1.5 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of submittal process.
  - 2. See Specification Section 40 05 05 and individual specification sections for submittal requirements for products defined as equipment.
  - 3. General requirements:
    - a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.

- b. Include data sheets that include manufacturer's name and product model number.
    - 1) Clearly identify all optional accessories.
  - c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
  - d. Manufacturer's delivery, storage, handling and installation instructions.
  - e. Product installation details.
  - f. See individual specification sections for any additional requirements.
- B. Operation and Maintenance Manuals:
- 1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content process of Operation and Maintenance Manuals.
- C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. See Specification Section 01 65 50.
- B. Protect nameplates on electrical equipment to prevent defacing.

## **1.7 AREA DESIGNATIONS**

- A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
  - 1. Outdoor areas, including reuse wet well:
    - a. Wet.
- B. All equipment will be designed for the following altitude and temperature ranges:
  - 1. Altitude: 5395 ft.
  - 2. Maximum temperature: 103°F
  - 3. Minimum temperature: -16°F

# **PART 2 - PRODUCTS**

## **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, refer to specific Division 26 Specification Sections and specific material paragraphs below for acceptable manufacturers.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.
- C. Provide all components of a similar type by one (1) manufacturer.

## **2.2 MATERIALS**

- A. Electrical Equipment Support Pedestals and/or Racks:
  - 1. Approved manufacturers:
    - a. Modular strut:
      - 1) Unistrut Building Systems.
      - 2) Eaton B-Line.
      - 3) Globe Strut.
      - 4) Thomas & Betts Superstrut.
  - 2. Material requirements:
    - a. Modular strut:
      - 1) Stainless steel: AISI Type 316.
    - b. Structural members (e.g., I beams, L and C channels):
      - 1) Aluminum: AA Type 6063-T6.
    - c. Mounting plates:

- 1) Aluminum: AA Type 6063-T6.
- d. Mounting hardware:
  - 1) Stainless steel.
- e. Anchorage per Specification Section 05 50 00.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.
- B. Install equipment in accordance with the requirements of:
  - 1. NFPA 70.
  - 2. IEEE.
  - 3. The manufacturer's instructions.
- C. In general, conduit routing is not shown on the Drawings.
  - 1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
  - 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.
- D. When complete branch circuiting is not shown on the Drawings:
  - 1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
  - 2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
  - 3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
  - 4. See Specification Section 26 05 19 for combining multiple branch circuits in a common conduit.
- E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.
- F. Install equipment plumb, square and true with construction features and securely fastened.
- G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.
- H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.
- I. Device Mounting Schedule:
  - 1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
    - a. Receptacle in non-architecturally finished areas (to center): 48 IN.
    - b. Safety switch (to center of operating handle): 54 IN.
    - c. Separately mounted motor starter (to center of operating handle): 54 IN.
    - d. Pushbutton or selector switch control station (to center): 48 IN.
    - e. Panelboard (to top): 72 IN.
- J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
  - 1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments in equipment locations in accordance with the following without obtaining the Engineer's approval:

- 1 a. 1 FT at grade, floor and roof level in any direction in the horizontal plane.
- 2 b. 1 FT on walls in a horizontal direction within the vertical plane.
- 3 c. Changes in equipment location exceeding those defined above require the Engineer's
- 4 approval.
- 5 K. Provide electrical equipment support system per the following area designations:
- 6 1. Wet areas:
- 7 a. Stainless steel system consisting of stainless steel channels and fittings, nuts and
- 8 hardware.
- 9 1) Includes aluminum structural members and mounting plates.
- 10 L. Provide all necessary anchoring devices and supports rated for the equipment load based on
- 11 dimensions and weights verified from approved submittals, or as recommended by the
- 12 manufacturer.
- 13 1. Do not cut, or weld to, building structural members.
- 14 2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure
- 15 mounting surface is properly braced to accept mounting of external equipment.
- 16 M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment
- 17 and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and
- 18 on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters,
- 19 Reservoirs, etc.
- 20 N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- 21 O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents
- 22 and insects.
- 23 P. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- 24 Q. Identify electrical equipment and components in accordance with Specification Section 10 14
- 25 00.

### 26 3.2 FIELD QUALITY CONTROL

- 27 A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided
- 28 by others.
- 29 1. See Specification Section 01 73 20 for openings and penetrations in structures.
- 30 B. Replace equipment and systems found inoperative or defective and re-test.
- 31 C. Cleaning:
- 32 1. See Specification Section 01 74 13.
- 33 D. The protective coating integrity of support structures and equipment enclosures shall be
- 34 maintained.
- 35 1. Repair painted components utilizing touch up paint provided by or approved by the
- 36 manufacturer.
- 37 2. Repair surfaces which will be inaccessible after installation prior to installation.
- 38 3. See Specification Section 26 05 33 for requirements for conduits and associated accessories.
- 39 E. Replace nameplates damaged during installation.

### 40 3.3 DEMONSTRATION

- 41 A. Demonstrate equipment in accordance with Specification Section 01 75 00.

## 42 END OF SECTION

**SECTION 26 05 19**  
**WIRE AND CABLE: 600 VOLT AND BELOW**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Material and installation requirements for:
    - a. Building wire.
    - b. Instrumentation cable.
    - c. Wire connectors.
    - d. Insulating tape.
    - e. Pulling lubricant.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
  3. Section 26 05 00 - Electrical: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. Insulated Cable Engineers Association (ICEA):
    - a. S-58-679, Standard for Control Cable Conductor Identification.
  2. National Electrical Manufacturers Association (NEMA):
    - a. ICS 4, Industrial Control and Systems: Terminal Blocks.
  3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
    - a. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
  4. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
  5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (ITA/EIA/ANSI):
    - a. 568, Commercial Building Telecommunications Cabling Standard.
  6. Underwriters Laboratories, Inc. (UL):
    - a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
    - b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
    - c. 467, Standard for Safety Grounding and Bonding Equipment.
    - d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
    - e. 486C, Standard for Safety Splicing Wire Connections.
    - f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
    - g. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
    - h. 2250, Standard for Safety Instrumentation Tray Cable.

**1.3 DEFINITIONS**

- A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- B. Instrumentation Cable:
1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.

- 1           2. The following are specific types of instrumentation cables:  
2           a. Analog signal cable:  
3           1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-  
4           10 Vdc) signals, using No. 16 AWG and smaller conductors.  
5           2) Commonly used types are defined in the following:  
6           a) TSP: Twisted shielded pair.  
7           b) TST: Twisted shielded triad.  
8           b. Digital signal cable: Used for the transmission of digital signals between computers,  
9           PLC's, RTU's, etc.  
10          C. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

## 11   **1.4 SUBMITTALS**

- 12          A. Shop Drawings:  
13          1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
14          the submittal process.  
15          2. Product technical data:  
16          a. Provide submittal data for all products specified in PART 2 of this Specification  
17          Section except:  
18          1) Wire connectors.  
19          2) Insulating tape.  
20          3) Cable lubricant.  
21          b. See Specification Section 26 05 00 for additional requirements.

## 22   **1.5 DELIVERY, STORAGE, AND HANDLING**

- 23          A. See Specification Section 26 05 00.

## 24   **PART 2 - PRODUCTS**

### 25   **2.1 ACCEPTABLE MANUFACTURERS**

- 26          A. Subject to compliance with the Contract Documents, the following manufacturers are  
27          acceptable:  
28          1. Building wire:  
29          a. Aetna Insulated Wire.  
30          b. Alphawire.  
31          c. Cerrowire.  
32          d. Encore Wire Corporation.  
33          e. General Cable.  
34          f. Okonite Company.  
35          g. Southwire Company.  
36          2. Instrumentation cable:  
37          a. Analog cable:  
38          1) Alphawire.  
39          2) Belden Inc.  
40          3) General Cable.  
41          3. Wire connectors:  
42          a. Burndy Corporation.  
43          b. Buchanan.  
44          c. Ideal.  
45          d. IlSCO.  
46          e. 3M Co.  
47          f. Teledyne Penn Union.  
48          g. Thomas and Betts.

- 1 h. Phoenix Contact.
- 2 4. Insulating and color coding tape:
- 3 a. 3M Co.
- 4 b. Plymouth Bishop Tapes.
- 5 c. Red Seal Electric Co.
- 6 B. Submit request for substitution in accordance with Specification Section 01 25 13.
- 7 **2.2 MANUFACTURED UNITS**
- 8 A. Building Wire:
- 9 1. Conductor shall be copper with 600 V rated insulation.
- 10 2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits
- 11 which may be stranded or solid.
- 12 3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and
- 13 UL label.
- 14 4. When direct buried, UL listed and marked as suitable for direct bury.
- 15 5. When exposed to sunlight, UL listed and marked as sunlight resistant.
- 16 6. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and
- 17 THHN/THWN-2 insulation.
- 18 7. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.
- 19 B. Electrical Equipment Control Wire:
- 20 1. Conductor shall be copper with 600 V rated insulation.
- 21 2. Conductors shall be stranded.
- 22 3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and
- 23 UL label.
- 24 4. Conform to UL 44 for Type SIS insulation.
- 25 5. Conform to UL 83 for Type MTW insulation.
- 26 C. Instrumentation Cable:
- 27 1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and
- 28 UL label.
- 29 2. Analog cable:
- 30 a. Tinned copper conductors.
- 31 b. 600 V PVC insulation with PVC jacket.
- 32 c. Twisted with 100 percent foil shield coverage with drain wire.
- 33 d. Six (6) twists per foot minimum.
- 34 e. When direct buried, UL listed and marked as suitable for direct bury.
- 35 f. When exposed to sunlight, UL listed and marked as sunlight resistant.
- 36 g. Individual conductor color coding: ICEA S-58-679, Method 1, Table E-2.
- 37 h. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
- 38 3. Digital cable:
- 39 a. As recommended by equipment (e.g., PLC, RTU) manufacturer.
- 40 b. Horizontal voice and data cable:
- 41 1) Category 6 per TIA/EIA/ANSI 568.
- 42 2) Cable shall be label-verified.
- 43 3) Cable jacket shall be factory marked at regular intervals indicating verifying
- 44 organization and performance level.
- 45 4) Conductors: No. 24 AWG solid untinned copper.
- 46 c. Rated CMP per NFPA 70.
- 47 D. Wire Connectors:
- 48 1. Twist/screw on type:
- 49 a. Insulated pressure or spring type solderless connector.
- 50 b. 600 V rated.
- 51 c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local
- 52 codes.

- 1 d. Phase and neutral conductors: Conform to UL 486C.
- 2 2. Compression and mechanical screw type:
- 3 a. 600 V rated.
- 4 b. Ground conductors: Conform to UL 467.
- 5 c. Phase and neutral conductors: Conform to UL 486A.
- 6 3. Terminal block type:
- 7 a. High density, screw-post barrier-type with white center marker strip.
- 8 b. 600 V and ampere rating as required, for power circuits.
- 9 c. 600 V, 20 ampere rated for control circuits.
- 10 d. 300 V, 15 ampere rated for instrumentation circuits.
- 11 e. Conform to NEMA ICS 4 and UL 486A.
- 12 E. Insulating and Color Coding Tape:
- 13 1. Pressure sensitive vinyl.
- 14 2. Premium grade.
- 15 3. Heat, cold, moisture, and sunlight resistant.
- 16 4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
- 17 5. For cold weather or outdoor location, tape must also be all-weather.
- 18 6. Color:
- 19 a. Insulating tape: Black.
- 20 b. Color coding tape: Fade-resistant color as specified herein.
- 21 7. Comply with UL 510.
- 22 F. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products
- 23 which will deteriorate insulation.

## 24 **PART 3 - EXECUTION**

### 25 **3.1 INSTALLATION**

- 26 A. Permitted Usage of Insulation Types:
- 27 1. Type XHHW-2:
- 28 a. Building wire No. 6 AWG and larger.
- 29 2. Type THHN/THWN and THHN/THWN-2:
- 30 a. Building wire and control cable No. 8 AWG and smaller.
- 31 3. Type SIS and MTW:
- 32 a. For the wiring of control equipment within control panels and field wiring of control
- 33 equipment within switchgear, switchboards, motor control centers.
- 34 B. Conductor Size Limitations:
- 35 1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless
- 36 otherwise indicated on the Drawings.
- 37 2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the
- 38 Drawings.
- 39 3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise
- 40 indicated on the Drawings.
- 41 C. Color Code All Wiring as Follows:
- 42 1. Building wire:
- 43

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray

Ground	Green	Green
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\* Orange when it is a high leg of a 120/240 V Delta system.

- a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
- b. Conductors larger than No. 6 AWG:
  - 1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
    - a) Continuous colored outer finish along its entire length.
    - b) 3 IN of colored tape applied at the termination.
  - 2) Insulated grounding conductor shall be identified by one (1) of the following methods:
    - a) Continuous green outer finish along its entire length.
    - b) Stripping the insulation from the entire exposed length.
    - c) Using green tape to cover the entire exposed length.
  - 3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
- D. Install all wiring in raceway unless otherwise indicated on the Drawings.
- E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
  1. Where specifically indicated on the Drawings.
  2. Where field conditions dictate and written permission is obtained from the Engineer.
  3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
    - a. The combinations shall comply with the following:
      - 1) AC control circuits shall be isolated from all DC circuits.
  4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
    - a. The combinations shall comply with the following:
      - 1) Analog signal circuits may be combined.
      - 2) Digital signal circuits may be combined but isolated from analog signal circuits.
  5. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
    - a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
      - 1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
      - 2) The neutral conductors may not be shared.
      - 3) Up sizing raceway size for the size and quantity of conductors.
- F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
  1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).
- G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
  1. Feeder and branch power circuits:
    - a. Device outlet boxes:
      - 1) Twist/screw on type connectors.
    - b. Junction and pull boxes and wireways:
      - 1) Twist/screw on type connectors for use on No. 8 and smaller wire.
      - 2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
    - c. Motor terminal boxes:

- 1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
- 2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
2. Control circuits:
  - a. Junction and pull boxes: Terminal block type connector.
  - b. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
3. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.
- H. Insulating Tape Usage:
  1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
  2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
  3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.
- I. Color Coding Tape Usage: For color coding of conductors.
- J. Kellums, or equal, woven grips shall support wire and cable in vertical risers where necessary to prevent heavy loading on wire or cable connections.
- K. Wire and cable shall not be pulled tight against bushings nor pressed heavily against enclosures.
- L. After wire and cable have been installed and connected, conduit ends shall be sealed with a non-hardening sealing compound (Duxseal or equal), forced into conduits to a minimum depth equal to the conduit diameter. This shall apply for all conduits, including spares, entering any structures or electrical enclosures from underground, or from wet areas.
- M. Tag wires with wire markers in control panels, electrical gear, terminal boxes: See Specification Section 10 14 00.

## END OF SECTION

## SECTION 26 05 26

### GROUNDING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Material and installation requirements for grounding system(s).
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 10 14 00 - Identification Devices.
  - 4. Section 26 05 00 - Electrical: Basic Requirements.
  - 5. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
  - 6. Section 26 05 33 - Raceways and Boxes.

##### 1.2 QUALITY ASSURANCE

- A. Referenced Standards:
  - 1. ASTM International (ASTM):
    - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
  - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
  - 3. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
      - 1) Article 250, Grounding and Bonding.
  - 4. Underwriters Laboratories, Inc. (UL):
    - a. 467, Grounding and Bonding Equipment.
- B. Assure ground continuity is continuous throughout the entire Project.

##### 1.3 SUBMITTALS

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data.
    - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
      - 1) Grounding clamps, terminals and connectors.
      - 2) Exothermic welding system.
    - b. See Specification Section 26 05 00 for additional requirements.

#### PART 2 - PRODUCTS

##### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. Ground rods and bars and grounding clamps, connectors and terminals:
    - a. Burndy.
    - b. Harger Lightning Protection.
    - c. Heary Brothers.
    - d. Joslyn.

- 1 e. Robbins Lightning Protection.
- 2 f. Thomas & Betts Blackburn.
- 3 g. Thompson.
- 4 2. Exothermic weld connections:
- 5 a. Erico Products Inc., Cadweld.
- 6 b. Harger Lightning Protection.
- 7 c. Thermoweld.
- 8 d. Thomas & Betts Furseweld.
- 9 B. Submit request for substitution in accordance with Specification Section 01 25 13.

10 **2.2 COMPONENTS**

- 11 A. Wire and Cable:
- 12 1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
- 13 2. Insulated conductors: Color coded green, per Specification Section 26 05 19.
- 14 B. Conduit: As specified in Specification Section 26 05 33.
- 15 C. Ground Rods:
- 16 1. 3/4 IN x 10 FT, or as indicated on the Drawings.
- 17 2. Copperclad:
- 18 a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
- 19 b. Corrosion resistant bond between the copper and steel.
- 20 c. Hard drawn for a scar-resistant surface.
- 21 D. Grounding Clamps, Connectors and Terminals:
- 22 1. Mechanical type:
- 23 a. Standards: UL 467.
- 24 b. High copper alloy content.
- 25 2. Compression type for interior locations:
- 26 a. Standards: UL 467.
- 27 b. High copper alloy content.
- 28 c. Non-reversible.
- 29 d. Terminals for connection to bus bars shall have two bolt holes.
- 30 3. Compression type suitable for direct burial in earth or concrete:
- 31 a. Standards: UL 467, IEEE 837.
- 32 b. High copper alloy content.
- 33 c. Non-reversible.
- 34 E. Exothermic Weld Connections:
- 35 1. Copper oxide reduction by aluminum process.
- 36 2. Molds properly sized for each application.

37 **PART 3 - EXECUTION**

38 **3.1 INSTALLATION**

- 39 A. General:
- 40 1. Install products in accordance with manufacturer's instructions.
- 41 2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250,
- 42 except where larger sizes are indicated on the Drawings.
- 43 3. Remove paint, rust, or other nonconducting material from contact surfaces before making
- 44 ground connections.
- 45 4. Where ground conductors pass through floor slabs or building walls provide nonmetallic
- 46 sleeves and install per Specification Section 01 73 20.
- 47 5. Do not splice grounding conductors except at ground rods.
- 48 6. Install ground rods and grounding conductors in undisturbed, firm soil.
- 49 a. Provide excavation required for installation of ground rods and ground conductors.

- 1 b. Use driving studs or other suitable means to prevent damage to threaded ends of
- 2 sectional rods.
- 3 c. Unless otherwise specified, connect conductors to ground rods with compressor type
- 4 connectors or exothermic weld.
- 5 d. Provide sufficient slack in grounding conductor to prevent conductor breakage during
- 6 backfill or due to ground movement.
- 7 e. Backfill excavation completely, thoroughly tamping to provide good contact between
- 8 backfill materials and ground rods and conductors.
- 9 7. Do not use exothermic welding if it will damage the structure the grounding conductor is
- 10 being welded to.
- 11 B. Grounding Electrode System:
- 12 1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as
- 13 indicated on the Drawings.
- 14 2. Grounding conductor terminations:
- 15 a. Ground bars in electrical equipment, use compression type terminal and bolt it to the
- 16 ground bar.
- 17 b. At all above grade terminations, the conductors shall be labeled per Specification
- 18 Section 10 14 00.
- 19 C. Supplemental Grounding Electrode:
- 20 1. Provide the following grounding in addition to the equipment ground conductor supplied
- 21 with the feeder conductors whether or not shown on the Drawings.
- 22 2. Equipment support rack and pedestals mounted outdoors:
- 23 a. Connect metallic structure to a ground rod.
- 24 b. Grounding conductor: #6 AWG minimum.
- 25 D. Low Voltage Transformer Separately Derived Grounding System:
- 26 1. Ground separately mounted step-down transformers XO terminal to one of the following:
- 27 a. Closest building steel using mechanical type terminal bolted to the steel, compression
- 28 type connection or exothermic weld.
- 29 b. Closest water pipe using a mechanical type connection.
- 30 E. Raceway Bonding/Grounding:
- 31 1. All metallic conduit shall be installed so that it is electrically continuous.
- 32 2. All conduits to contain a grounding conductor with insulation identical to the phase
- 33 conductors, unless otherwise indicated on the Drawings.
- 34 3. NFPA 70 required grounding bushings shall be of the insulating type.
- 35 4. Provide double locknuts at all panels.
- 36 5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
- 37 6. Provide bonding jumpers if conduits are installed in concentric knockouts.
- 38 7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment
- 39 grounding system will operate continuously at ground potential to provide low impedance
- 40 current path for proper operation of overcurrent devices during possible ground fault
- 41 conditions.
- 42 F. Equipment Grounding:
- 43 1. All utilization equipment shall be grounded with an equipment ground conductor.

### 44 3.2 FIELD QUALITY CONTROL

- 45 A. Leave grounding system uncovered until observed by Owner.

46 **END OF SECTION**



**SECTION 26 05 33**  
**RACEWAYS AND BOXES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Material and installation requirements for:
    - a. Conduits.
    - b. Conduit fittings.
    - c. Conduit supports.
    - d. Wireways.
    - e. Outlet boxes.
    - f. Pull and junction boxes.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
  3. Section 05 50 00 - Metal Fabrications.
  4. Section 26 05 00 - Electrical: Basic Requirements.
  5. Section 26 05 43 - Electrical: Exterior Underground.
  6. Section 26 27 26 - Wiring Devices.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. American Iron and Steel Institute (AISI).
  2. ASTM International (ASTM):
    - a. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
  3. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    - b. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
    - c. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
  4. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
    - a. C80.1, Electric Rigid Steel Conduit (ERSC).
  5. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
  6. Underwriters Laboratories, Inc. (UL):
    - a. 6, Standard for Electrical Rigid Metal Conduit - Steel.
    - b. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
    - c. 360, Standard for Liquid-Tight Flexible Steel Conduit.
    - d. 467, Grounding and Bonding Equipment.
    - e. 514A, Metallic Outlet Boxes.
    - f. 514B, Conduit, Tubing, and Cable Fittings.
    - g. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
    - h. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

**1.3 SUBMITTALS**

- A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data:
  - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
    - 1) Conduit fittings.
    - 2) Support systems.
  - b. See Specification Section 26 05 00 for additional requirements.
3. Fabrication and/or layout drawings:
  - a. Identify dimensional size of pull and junction boxes to be used.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. See Specification Section 26 05 00.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  1. Rigid metallic conduits:
    - a. Allied Tube and Conduit Corporation.
    - b. Triangle PWC Inc.
    - c. Western Tube and Conduit Corporation.
    - d. Wheatland Tube Company.
    - e. LTV Steel Company.
  2. Rigid nonmetallic conduit:
    - a. Carlon.
    - b. Cantex.
    - c. Osburn Associates.
  3. Flexible conduit:
    - a. AFC Cable Systems.
    - b. Anamet, Inc.
    - c. Electri-Flex.
    - d. Flexible Metal Hose Company.
    - e. International Metal Hose Company.
    - f. Triangle PWC Inc.
    - g. LTV Steel Company.
  4. Wireway:
    - a. Hoffman Engineering Company.
    - b. Wiegmann.
    - c. Square D.
  5. Conduit fittings and accessories:
    - a. Appleton Electric Co.
    - b. Carlon.
    - c. Cantex.
    - d. Crouse-Hinds.
    - e. Killark.
    - f. Osburn Associates.
    - g. OZ Gedney Company.
    - h. RACO.
    - i. Steel City.
    - j. Thomas & Betts.
  6. Support systems:
    - a. Unistrut Building Systems.
    - b. Eaton B-Line.
    - c. Kindorf.

- 1 d. Minerallac Fastening Systems.
- 2 e. Caddy.
- 3 f. Thomas & Betts Superstrut.
- 4 7. Outlet, pull and junction boxes:
- 5 a. Appleton Electric Co.
- 6 b. Eaton Crouse-Hinds.
- 7 c. Killark.
- 8 d. O-Z/Gedney.
- 9 e. Thomas & Betts Steel City.
- 10 f. Raco.
- 11 g. Bell.
- 12 h. Hoffman Engineering Co.
- 13 i. Wiegmann.
- 14 j. Eaton B-Line.
- 15 k. Adalet.
- 16 l. Rittal.
- 17 m. Stahlin.
- 18 B. Submit request for substitution in accordance with Specification Section 01 25 13.

## 19 **2.2 RIGID METALLIC CONDUITS**

- 20 A. Rigid Galvanized Steel Conduit (RGS):
- 21 1. Mild steel with continuous welded seam.
- 22 2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
- 23 3. Threads galvanized after cutting.
- 24 4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
- 25 5. Standards: NEMA/ANSI C80.1, UL 6.

## 26 **2.3 RIGID NONMETALLIC CONDUIT**

- 27 A. Schedules 40 (PVC-40) and 80 (PVC-80):
- 28 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve
- 29 weatherability and heat distribution.
- 30 2. Rated for direct sunlight exposure.
- 31 3. Fire retardant and low smoke emission.
- 32 4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
- 33 5. Standards: NEMA TC 2, UL 651.

## 34 **2.4 FLEXIBLE CONDUIT**

- 35 A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
- 36 1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive
- 37 convolutions securely interlocked.
- 38 2. Extruded PVC outer jacket positively locked to the steel core.
- 39 3. Liquid and vaportight.
- 40 4. Standard: UL 360.

## 41 **2.5 WIREWAY**

- 42 A. General:
- 43 1. Suitable for lay-in conductors.
- 44 2. Designed for continuous grounding.
- 45 3. Covers:
- 46 a. Hinged or removable in accessible areas.
- 47 b. Non-removable when passing through partitions.
- 48 4. Finish: Rust inhibiting primer and manufacturers standard paint inside and out except for
- 49 stainless steel type.
- 50 5. Standards: UL 870, NEMA 250.

- 1 B. Watertight (NEMA 4X rated) Wireway:  
2 1. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA  
3 stainless steel flanges.  
4 2. Cover: Fully gasketed and held in place with captive clamp type latches.  
5 3. Flanges: Fully gasketed and bolted.

6 **2.6 CONDUIT FITTINGS AND ACCESSORIES**

- 7 A. Fittings for Use with RGS:  
8 1. Locknuts:  
9 a. Threaded steel or malleable iron.  
10 b. Gasketed or non-gasketed.  
11 c. Grounding or non-grounding type.  
12 2. Bushings:  
13 a. Threaded, insulated metallic.  
14 b. Grounding or non-grounding type.  
15 3. Hubs: Threaded, insulated and gasketed metallic for raintight connection.  
16 4. Couplings:  
17 a. Threaded straight type: Same material and finish as the conduit with which they are  
18 used on.  
19 b. Threadless type: Gland compression or self-threading type, concrete tight.  
20 5. Unions: Threaded galvanized steel or zinc plated malleable iron.  
21 6. Conduit bodies (ells and tees):  
22 a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.  
23 b. Standard and mogul size.  
24 c. Cover:  
25 1) Clip-on type with stainless steel screws.  
26 2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free  
27 aluminum.  
28 7. Conduit bodies (round):  
29 a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.  
30 b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast  
31 copper free aluminum.  
32 8. Expansion couplings:  
33 a. 2 IN nominal straight-line conduit movement in either direction.  
34 b. Galvanized steel with insulated bushing.  
35 c. Gasketed for wet locations.  
36 d. Internally or externally grounded.  
37 9. Expansion/deflection couplings:  
38 a. 3/4 IN nominal straight-line conduit movement in either direction.  
39 b. 30-degree nominal deflection from the normal in all directions.  
40 c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.  
41 d. Internally or externally grounded.  
42 e. Watertight, raintight and concrete tight.  
43 10. Standards: UL 467, UL 514B.  
44 B. Fittings for Use with FLEX-LT:  
45 1. Connector:  
46 a. Straight or angle type.  
47 b. Metal construction, insulated and gasketed.  
48 c. Composed of locknut, grounding ferrule and gland compression nut.  
49 d. Liquid tight.  
50 2. Standards: UL 467, UL 514B.  
51 C. Fittings for Use with Rigid Nonmetallic PVC Conduit:  
52 1. Coupling, adapters and conduit bodies:  
53 a. Same material, thickness, and construction as the conduits with which they are used.

- 1                   b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
- 2                   c. Bore smooth and free of blisters, nicks or other imperfections which could damage the
- 3                   conductor.
- 4               2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the
- 5               conduit and fittings.
- 6               3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.
- 7       D. Weather and Corrosion Protection Tape:
- 8           1. PVC based tape, 10 mils thick.
- 9           2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
- 10          3. Used with appropriate pipe primer.

## 11   **2.7 ALL RACEWAY AND FITTINGS**

- 12       A. Mark Products:
- 13           1. Identify the nominal trade size on the product.
- 14           2. Stamp with the name or trademark of the manufacturer.

## 15   **2.8 OUTLET BOXES**

- 16       A. Cast Outlet Boxes:
- 17           1. Zinc plated cast iron or die-cast copper free aluminum with manufacturers standard finish.
- 18           2. Threaded hubs and grounding screw.
- 19           3. Styles:
- 20               a. "FS" or "FD".
- 21               b. "Bell".
- 22               c. Single or multiple gang and tandem.
- 23           4. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
- 24           5. Standards: UL 514A.
- 25       B. See Specification Section 26 27 26 for wiring devices, wallplates and coverplates.

## 26   **2.9 PULL AND JUNCTION BOXES**

- 27       A. NEMA 4X Rated (metallic):
- 28           1. Body and cover: 14 GA Type 304 or 316 stainless steel.
- 29           2. Seams continuously welded and ground smooth.
- 30           3. No knockouts.
- 31           4. External mounting flanges.
- 32           5. Hinged door and stainless steel screws and clamps.
- 33           6. Door with oil-resistant gasket.
- 34       B. Miscellaneous Accessories:
- 35           1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
- 36           2. Split covers when heavier than 25 LBS.
- 37           3. Weldnuts for mounting optional panels and terminal kits.
- 38           4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.
- 39       C. Standards: NEMA 250, UL 50.

## 40   **2.10 SUPPORT SYSTEMS**

- 41       A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
- 42           1. Material requirements.
- 43               a. Stainless steel: AISI Type 316.
- 44       B. Single Conduit and Outlet Box Support Fasteners:
- 45           1. Material requirements:
- 46               a. Stainless steel.

## 2.11 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

- A. Sleeves, smoke and fire stop fitting through walls and floors:
  - 1. See Specification Section 01 73 20.

## PART 3 - EXECUTION

### 3.1 RACEWAY INSTALLATION - GENERAL

- A. Shall be in accordance with the requirements of:
  - 1. NFPA 70.
  - 2. Manufacturer instructions.
- B. Size of Raceways:
  - 1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
  - 2. Unless specifically indicated otherwise, the minimum raceway size shall be:
    - a. Conduit: 3/4 IN.
    - b. Wireway: 2-1/2 IN x 2-1/2 IN.
- C. Field Bending and Cutting of Conduits:
  - 1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
  - 2. Do not reduce the internal diameter of the conduit when making conduit bends.
  - 3. Prepare tools and equipment to prevent damage to the PVC coating.
  - 4. Degrease threads after threading and apply a zinc rich paint.
  - 5. Debur interior and exterior after cutting.
- D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.
- E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
  - 1. Repair galvanized components utilizing a zinc rich paint.
  - 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
  - 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
    - a. Total nominal thickness: 40 mil.
  - 4. Repair surfaces which will be inaccessible after installation prior to installation.
- F. Remove moisture and debris from conduit before wire is pulled into place.
  - 1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
  - 2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
  - 3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.
- G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.
- I. Fill openings in walls, floors, and ceilings and finish flush with surface.
  - 1. See Specification Section 01 73 20.

### 3.2 RACEWAY ROUTING

- A. Raceways shall be routed in the field unless otherwise indicated.
  - 1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
  - 2. Run in straight lines parallel to or at right angles to building lines.
  - 3. Do not route conduits:
    - a. Through areas of high ambient temperature or radiant heat.
    - b. In suspended concrete slabs.
  - 4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
  - 5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.
- B. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:
  - 1. Between process, gas, air and water pipes: 6 IN.
- C. Conduits shall be installed to eliminate moisture pockets.
  - 1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.
- D. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.
- E. Provide all required openings in walls, floors, and ceilings for conduit penetration.
  - 1. See Specification Section 01 73 20.
- F. Conduit buried under slab-on-grade:
  - 1. Run in the most direct, practical route.
  - 2. Not to be installed under equipment pads unless approved by Engineer.
  - 3. No crossovers unless approved by the Engineer.
  - 4. To be backfilled with concrete during the installation of the slab-on-grade.
  - 5. Secured in place to prevent movement during the backfill and pour.

### 3.3 RACEWAY APPLICATIONS

- A. Permitted Raceway Types Per Wire or Cable Types:
  - 1. Power wire or cables: All raceway types.
  - 2. 120V control wire or cables: All raceway types.
  - 3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
- B. Permitted Raceway Types Per Area Designations:
  - 1. Exposed:
    - a. RGS.
- C. Permitted Raceway Types Per Routing Locations:
  - 1. Beneath floor slab-on-grade:
    - a. PVC-40.
  - 2. Through floor penetrations, see Specification Section 01 73 20:
  - 3. Direct buried conduits and ductbanks:
    - a. PVC-80.
    - b. 90 degree elbows for transitions to above grade:
      - 1) RGS wrapped with factory applied weather and corrosion protection tape.
    - c. Long sweeping bends greater than 15 degrees:
      - 1) RGS wrapped with factory applied weather and corrosion protection tape.
  - 4. Concrete encased ductbanks:
    - a. PVC-40.
    - b. 90 degree elbows for transitions to above grade:
      - 1) RGS wrapped with factory applied weather and corrosion protection tape.

- 1 c. Long sweeping bends greater than 15 degrees:
- 2 1) RGS for sizes 2 IN and larger.
- 3 D. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type
- 4 transformers, motors, electrically operated valves, instrumentation primary elements, and other
- 5 electrical equipment that is liable to vibrate.
- 6 1. The maximum length shall not exceed:
- 7 a. 6 FT to light fixtures.
- 8 b. 3 FT to motors.
- 9 c. 2 FT to all other equipment.
- 10 E. NEMA 4X Rated Wireway:
- 11 1. Surface mounted in areas designated as wet.
- 12 F. Underground Conduit: See Specification Section 26 05 43.

### 13 3.4 CONDUIT FITTINGS AND ACCESSORIES

- 14 A. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
- 15 1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated
- 16 1/4 turn to provide uniform contact.
- 17 B. Install Expansion Fittings:
- 18 1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
- 19 2. Elsewhere as identified on the Drawings.
- 20 C. Install Expansion/Deflection Fittings:
- 21 1. Where conduits enter a structure.
- 22 a. Except electrical manholes and handholes.
- 23 b. Except where the ductbank is tied to the structure with rebar.
- 24 2. Where conduits span structural expansions joints.
- 25 3. Elsewhere as identified on the Drawings.
- 26 D. Threaded connections shall be made wrench-tight.
- 27 E. Conduit joints shall be watertight:
- 28 1. Where subjected to possible submersion.
- 29 2. In areas classified as wet.
- 30 3. Underground.
- 31 F. Terminate Conduits:
- 32 1. In metallic outlet boxes:
- 33 a. Conduit hub and locknut.
- 34 b. Insulated bushing and two (2) locknuts.
- 35 c. Use grounding type locknut or bushing when required by NFPA 70.
- 36 2. In NEMA 4X rated enclosures:
- 37 a. Watertight, insulated and gasketed hub and locknut.
- 38 3. When stubbed up through the floor into floor mount equipment:
- 39 a. With an insulated grounding bushing on metallic conduits.
- 40 b. With end bells on nonmetallic conduits.

### 41 3.5 CONDUIT SUPPORT

- 42 A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit
- 43 types:
- 44 1. Wet areas:
- 45 a. Stainless steel system consisting of: Stainless steel channels and fittings, nuts and
- 46 hardware and conduit clamps.
- 47 B. Permitted single conduit support fasteners per area designations and conduit types:
- 48 1. Wet areas:
- 49 a. Material: Stainless steel.





**SECTION 26 05 43**  
**ELECTRICAL: EXTERIOR UNDERGROUND**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Material and installation requirements for:
    - a. Underground conduits and ductbanks.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 31 21 33 - Trenching, Backfilling and Compacting for Utilities.
  - 4. Division 03 - Concrete.
  - 5. Section 10 14 00 - Identification Devices.
  - 6. Section 26 05 26 - Grounding.
  - 7. Section 26 05 33 - Raceways and Boxes.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Association of State Highway and Transportation Officials (AASHTO):
    - a. HB, Standard Specifications for Highway Bridges.
  - 2. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).

**1.3 DEFINITIONS**

- A. Direct-buried conduit(s):
  - 1. Individual (single) underground conduit.
  - 2. Multiple underground conduits, arranged in one or more planes, in a common trench.
- B. Concrete encased ductbank: An individual (single) or multiple conduit(s), arranged in one or more planes, encased in a common concrete envelope.

**1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data:
    - a. Provide submittal data for all products specified in PART 2 of this Specification Section.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. Ductbank accessories:
    - a. Neenah.
    - b. Unistrut.
    - c. Condux International, Inc.
    - d. Underground Devices, Inc.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

## 2.2 UNDERGROUND CONDUIT AND ACCESSORIES

- A. Concrete: Comply with Division 03 Specifications.
- B. Conduit: See Specification Section 26 05 33.
- C. Duct Spacers/Supports:
  - 1. High density polyethylene or high impact polystyrene.
  - 2. Interlocking.
  - 3. Provide 2 IN minimum spacing between conduits.
  - 4. Accessories, as required:
    - a. Hold down bars.
    - b. Ductbank strapping.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Drawings indicate the intended routing of ductbanks and direct buried conduit.
  - 1. Field conditions may affect actual routing.
- B. Install products in accordance with manufacturer's instructions.
- C. Comply with Specification Section 31 21 33 for trenching, backfilling and compacting.

### 3.2 UNDERGROUND CONDUITS

- A. General Installation Requirements:
  - 1. Unless otherwise noted on the Drawings, all underground conduits shall be concrete-encased.
  - 2. Do not place concrete or soil until conduits have been observed by the Engineer.
  - 3. Ductbanks shall be sloped a minimum of 4 IN per 100 FT or as detailed on the Drawings.
  - 4. During construction and after conduit installation is complete, plug the ends of all conduits.
  - 5. Provide conduit supports and spacers.
    - a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
      - 1) 1 IN and less: 3 FT.
      - 2) 1-1/4 to 3 IN: 5 FT.
      - 3) 3-1/2 to 6 IN: 7 FT.
    - b. Place supports and spacers for rigid steel conduit on maximum centers as indicated for the following trade sizes:
      - 1) 1 IN and less: 10 FT.
      - 2) 1-1/4 to 2-1/2 IN: 14 FT.
      - 3) 3 IN and larger: 20 FT.
    - c. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
  - 6. Stagger conduit joints at intervals of 6 IN vertically.
  - 7. Make conduit joints watertight and in accordance with manufacturer's recommendations.
  - 8. Accomplish changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 25 FT.
    - a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
  - 9. Furnish manufactured bends at end of runs.
    - a. Minimum radius of 18 IN for conduits less than 3 IN trade size and 36 IN for conduits 3 IN trade size and larger.
  - 10. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
  - 11. After the conduit run has been completed:

- a. Prove joint integrity and test for out-of-round duct by pulling a test mandrel through each conduit.
    - 1) Test mandrel:
      - a) Length: Not less than 12 IN
      - b) Diameter: Approximately 1/4 IN less than the inside diameter of the conduit.
    - b. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.
  12. Pneumatic rodding may be used to draw in lead wire.
    - a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
    - b. Extend cord 3 FT beyond ends of conduit.
  13. Transition from rigid nonmetallic conduit to rigid metallic conduit, per Specification Section 26 05 33, prior to entering a structure or going above ground.
    - a. Except rigid nonmetallic conduit may be extended directly to manholes, handholes, pad mounted transformer boxes and other exterior pad mounted electrical equipment where the conduit is concealed within the enclosure.
    - b. Terminate rigid PVC conduits with end bells.
    - c. Terminate steel conduits with insulated bushings.
  14. Place warning tape in trench directly over ductbanks, direct-buried conduit, and direct-buried wire and cable in accordance with Specification Section 10 14 00.
- B. Concrete Encased Ductbank:
1. Ductbank system consists of conduits completely encased in minimum 2 IN of concrete and with separations between different cabling types as required in Specification Section 26 05 33 or as detailed on the Drawings.
  2. Install so that top of concrete encased duct, at any point:
    - a. Is not less than 24IN below grade.
    - b. Is below pavement sub-grading.
  3. Conduit supports shall provide a uniform minimum clearance of 2 IN between the bottom of the trench and the bottom row of conduit.
  4. Conduit separators shall provide a uniform minimum clearance of 2 IN between conduits or as required in Specification Section 26 05 33 for different cabling types.
- C. Direct-Buried Conduit(s):
1. Install so that the top of the uppermost conduit, at any point:
    - a. Is not less than 30 IN below grade.
    - b. Is below pavement sub-grading.
  2. Provide a uniform minimum clearance of 2 IN between conduits or as required in Specification Section 26 05 33 for different cabling types.
    - a. Maintain the separation of multiple planes of conduits by one of the following methods:
      - 1) Install multilevel conduits with the use of conduit supports and separators to maintain the required separations, and backfill with flowable fill (100 PSI) or concrete per Specification Section 31 21 33.
      - 2) Install the multilevel conduits one level at a time.
        - a) Each level is backfilled with the appropriate amount of soil and compaction, per Specification Section 31 21 33, to maintain the required separations.

## END OF SECTION



**SECTION 26 26 13**  
**PACKAGE POWER SUPPLY**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Package power supply consisting of a transformer and panelboard.
- B. Related Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 26 05 00 - Electrical: Basic Requirements.
  - 4. Section 26 05 26 - Grounding.
  - 5. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. C57.96, Loading Dry-Type Distribution and Power Transformers.
  - 2. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    - b. PB 1, Panelboards.
    - c. ST 20, Dry-Type Transformers for General Applications.
  - 3. Underwriters Laboratories, Inc. (UL):
    - a. 67, Standard for Safety Panelboards.
    - b. 1561, Standard for Safety Dry-Type General Purpose and Power Transformers.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data:
    - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    - b. See Specification Section 26 05 00 for additional requirements.
  - 3. Fabrication and/or layout drawings:
    - a. Nameplate drawing.
    - b. Panelboard layout with alphanumeric designation, branch circuit breakers size and type, as indicated in the panelboard schedules.
- B. Operation and Maintenance Manuals:
  - 1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. General Electric Company.
  - 2. Square D Company.
  - 3. Eaton.

- 1                   4. Siemens.
- 2           B. Submit request for substitution in accordance with Specification Section 01 25 13.
- 3   **2.2 PACKAGED POWER SUPPLY**
- 4           A. General:
- 5               1. Standards: IEEE C57.96, NEMA PB 1, NEMA ST 20, UL 67 and UL 1561.
- 6               2. Package power supply includes a main primary circuit breaker, an encapsulated dry-type
- 7               transformer and a secondary panelboard with main circuit breaker.
- 8           B. Ratings:
- 9               1. Single or three (3) phase as indicated on the Drawings.
- 10              2. KVA and voltage ratings as indicated on the Drawings.
- 11              3. Suitable for use as service entrance equipment.
- 12           C. Transformer:
- 13               1. Non-ventilated, air cooled, two (2) winding type.
- 14               2. Core and coil assembly encapsulated in a proportioned mixture of resin and aggregate to
- 15               provide a moistureproof, shock resistant seal.
- 16               3. Cores:
- 17                   a. High grade, non-aging silicon steel with high magnetic permeability, and low hysteresis
- 18                   and eddy current losses.
- 19                   b. Magnetic flux densities are to be kept well below the saturation point.
- 20               4. Coils: Continuous wound with electrical grade aluminum and grounded to the enclosure.
- 21               5. Insulation system: 185 DegC with a 115 DegC rise.
- 22               6. Taps: Two (2) 5 percent FCBN.
- 23               7. Sound levels:
- 24                   a. Manufacturer shall guarantee not to exceed the following:
- 25                       1) 9 kVA and less: 40 dB.
- 26                       2) 10 to 30 kVA: 45 dB.
- 27           D. Panelboard and Protective Devices:
- 28               1. Bus: Aluminum.
- 29               2. Factory installed wiring between primary breaker and transformer, secondary breaker and
- 30               transformer and distribution section.
- 31               3. 480 Vac primary circuit breaker: 14,000 amp minimum interrupting rating.
- 32               4. 240 Vac or less secondary circuit breaker: 10,000 amp minimum interrupting rating.
- 33               5. Feeder breakers:
- 34                   a. Plug-in type with 10,000 amp minimum interrupting rating.
- 35                   b. See Section 26 28 00 for additional requirements.
- 36           E. Enclosure:
- 37               1. Main, secondary and feeder circuit breakers enclosed with a padlockable hinged door.
- 38               2. Wiring compartment suitable for conduit entry and large enough to allow convenient wiring.
- 39               3. Totally enclosed, non-ventilated, NEMA 3R, stainless steel finished with a rust inhibitor
- 40               primer and manufacturer's standard paint.

41   **PART 3 - EXECUTION**

42   **3.1 INSTALLATION**

- 43           A. Install products in accordance with manufacturer's instructions.
- 44           B. Ground in accordance with Section 26 05 26 or as indicated on the Drawings.

45                                   **END OF SECTION**

**SECTION 26 27 26**  
**WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Material and installation requirements for:
    - a. Receptacles.
    - b. Device wallplates and coverplates.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 26 05 00 - Electrical: Basic Requirements.
  - 4. Section 26 05 33 - Raceways and Boxes.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. National Electrical Manufacturers Association (NEMA):
    - a. WD 1, General Color Requirements for Wiring Devices.
    - b. WD 6, Wiring Devices - Dimensional Requirements.
  - 2. Underwriters Laboratories, Inc. (UL):
    - a. 498, Standard for Attachment Plugs and Receptacles.
    - b. 514A, Metallic Outlet Boxes.
    - c. 943, Ground-Fault Circuit-Interrupters.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data:
    - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    - b. See Specification Section 26 05 00 for additional requirements.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. Receptacles:
    - a. Bryant.
    - b. Eaton Cooper Wiring Devices.
    - c. Hubbell.
    - d. Leviton.
    - e. Pass & Seymour.
    - f. Eaton Crouse-Hinds.
    - g. Appleton Electric Co.
    - h. Killark.

1 B. Submit request for substitution in accordance with Specification Section 01 25 13.

2 **2.2 RECEPTACLES**

- 3 A. General requirements unless modified in specific requirements paragraph of receptacles per  
4 designated areas:
- 5 1. Straight blade, Industrial Specification Grade.
  - 6 2. Brass triple wipe line contacts.
  - 7 3. One-piece grounding system with double wipe brass grounding contacts and self grounding  
8 strap.
  - 9 4. Back and side wired.
  - 10 5. Rated 20 A, 125 Vac.
  - 11 6. High impact nylon body.
  - 12 7. Receptacle body color:
    - 13 a. Normal power: Ivory.
  - 14 8. Types as indicated on the Drawings:
    - 15 a. Ground fault circuit interrupter: Feed-through type with test and reset buttons.
  - 16 9. Duplex or simplex as indicated on the Drawings.
  - 17 10. Configuration: NEMA 5-20R.
  - 18 11. Standards: UL 498, UL 514A, UL 943, NEMA WD 1, NEMA WD 6.
- 19 B. Exterior Locations:
- 20 1. Coverplate: Weatherproof (NEMA 3R) while in use, gasketed, copper-free aluminum, 2.5  
21 IN minimum cover depth.

22 **PART 3 - EXECUTION**

23 **3.1 INSTALLATION**

- 24 A. Install products in accordance with manufacturer's instructions.
- 25 B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 26 05  
26 00.
- 27 C. See Specification Section 26 05 33 for device outlet box requirements.
- 28 D. Provide blank plates for empty outlets.

29 **END OF SECTION**

**SECTION 26 28 00**  
**OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Low voltage circuit breakers.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 26 05 00 - Electrical: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. National Electrical Manufacturers Association (NEMA):
    - a. AB 1, Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures. (Equivalent to UL 489)
  - 2. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
  - 3. Underwriters Laboratories, Inc. (UL):
    - a. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data including:
    - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    - b. See Specification Section 26 05 00 for additional requirements.
- B. Operation and Maintenance Manuals:
  - 1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.
- C. Informational Submittals:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. Circuit breakers:
    - a. Eaton.
    - b. General Electric Company.
    - c. Square D Company.

- 1 d. Siemens.
- 2 B. Submit request for substitution in accordance with Specification Section 01 25 13.

3 **2.2 CIRCUIT BREAKERS**

- 4 A. Molded Case Type:
  - 5 1. General:
    - 6 a. Standards: NEMA AB 1, UL 489.
    - 7 b. Unit construction.
    - 8 c. Over-center, toggle handle operated.
    - 9 d. Quick-make, quick-break, independent of toggle handle operation.
    - 10 e. Manual and automatic operation.
    - 11 f. All poles open and close simultaneously.
    - 12 g. Three (3) position handle: On, off and tripped.
    - 13 h. Molded-in ON and OFF markings on breaker cover.
    - 14 i. One-, two- or three-pole as indicated on the Drawings.
    - 15 j. Current and interrupting ratings as indicated on the Drawings.
    - 16 k. Bolt on type.
  - 17 2. Thermal magnetic type:
    - 18 a. Inverse time overload and instantaneous short circuit protection by means of a thermal
    - 19 magnetic element.
    - 20 b. Frame size 150 amp and below:
      - 21 1) Non-interchangeable, non-adjustable thermal magnetic trip units.
  - 22 3. Motor circuit protector:
    - 23 a. Adjustable instantaneous short circuit protection by means of a magnetic or solid state
    - 24 trip element.
    - 25 b. Sized for the connected motor.

26 **PART 3 - EXECUTION**

27 **3.1 INSTALLATION**

- 28 A. Current and interrupting ratings as indicated on the Drawings.
- 29 B. Series rated systems not acceptable.
- 30 C. Devices shall be ambient temperature compensated.
- 31 D. Circuit Breakers:
  - 32 1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on
  - 33 the Drawings:
    - 34 a. Frame sizes 250 amp and less shall be thermal magnetic type.
    - 35 b. Motor circuit protectors sized for the connected motor.

37 **END OF SECTION**

**SECTION 26 28 17**  
**SEPARATELY MOUNTED CIRCUIT BREAKERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Separately mounted circuit breakers.
- B. Related Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 26 05 00 - Electrical: Basic Requirements.
  - 4. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. Underwriters Laboratories, Inc. (UL):
    - a. 489, Standard for Safety Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data:
    - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    - b. Provide a table that associates equipment model number with equipment tag number.
    - c. See Specification Section 26 05 00 for additional requirements.
- B. Operation and Maintenance Manuals:
  - 1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. Eaton.
  - 2. General Electric Company.
  - 3. Square D Company.
  - 4. Siemens.
  - 5. Appleton Electric Company.
  - 6. Crouse-Hinds.
  - 7. Killark.

1 B. Submit request for substitution in accordance with Specification Section 01 25 13.

2 **2.2 COMPONENTS**

3 A. NEMA 4X rated:

- 4 1. Body and cover: Type 304 or 316 stainless steel.  
5 2. No knockouts, external mounting flanges, hinged and gasketed door.  
6 3. Front operating handle padlockable in the OFF position and interlocked to prevent door  
7 from opening when the breaker is ON.  
8 4. Suitable for service entrance.

9 B. Standards: UL 489.

10 C. Overcurrent and short circuit protective devices:

- 11 1. Molded case circuit breaker.  
12 2. See Section 26 28 00 for overcurrent and short circuit protective device requirements.  
13 3. Factory installed.

14 **PART 3 - EXECUTION**

15 **3.1 INSTALLATION**

16 A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

17 B. Permitted uses of NEMA 4X enclosure:

- 18 1. Surface mounted in areas designated as wet.

20 **END OF SECTION**

**SECTION 27 21 00**  
**TELEMETRY SYSTEMS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Items required include but are not necessarily limited to the following:
    - a. Wireless I/O radios.
    - b. Antennas, masts, and associated appurtenances.
    - c. RTUs (Remote Terminal Units).
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
  3. Section 10 14 00 - Identification Devices.
  4. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.
  5. Section 40 98 00 - Control Panels and Enclosures.
  6. Section 40 99 00 - Surge Protection Devices (SPD) For Instrumentation and Control Equipment.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. Federal Communications Commission (FCC):
    - a. 47 CFR 15 - Radio Frequency Devices, Section 15.247 - Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.
  2. International Electrotechnical Commission (IEC):
    - a. 61131-3 - Programmable Controllers, Part 3: Programming Languages.
  3. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
    - a. 222-G, Structural Standards for Steel Antenna Towers and Antenna Supporting Structures.
  4. Underwriters Laboratories, Inc. (UL):
    - a. 508A, Standard for Safety Industrial Control Panels.

**1.3 DEFINITIONS**

- A. ARQ (Automatic Resend Query): Method of error correction where the receiver initiates an order to retransmit data blocks that are determined to be corrupted in transmission.
- B. BER (Bit Error Rate):
1. Ratio of the number of bits received in error to the total number of bits transmitted.
  2. Used as a measure of quality for data links.
- C. CRC (Cyclic Redundancy Check):
1. A method utilized for detecting errors in data transmission or storage.
  2. A number is calculated on the originating end based on the message contents, and then appended to the message before transmission.
  3. The CRC is re-calculated on the receiving end, and compared to the previously calculated value.
  4. A match of the two (2) calculated values indicates a high probability that the message was received correctly.
- D. Omnidirectional Antenna: An antenna that radiates maximum power uniformly 360 degrees in the horizontal plane.
- E. RTU (Remote Terminal Unit):

1. A remotely located device that collects data, codes the data into a format that is transmittable and transmits the data back to a central Supervisory Control and Data Acquisition (SCADA) system.
  2. The RTU also receives communication from the SCADA system and implements processes as directed.
- F. Spread Spectrum:
1. Communications technique whereby a radio frequency signal is spread (modulated) in order to generate an expanded bandwidth signal.
    - a. Frequency Hopping Spread Spectrum: Communications technique where the frequency of the radio signal repeatedly "hops" from one (1) frequency to another in accordance with a random but predictable sequence.
    - b. Direct Sequence Spread Spectrum: Communications technique whereby the stream of information (data signal) is combined with a higher data-rate bit sequence, or chipping code, that divides the user data according to a spreading ratio.
- G. Yagi Antenna:
1. A uni-directional radio antenna, consisting of a driven element, a reflector, and one or more directors.
  2. The antenna is primarily used for frequencies above 10 MHz and are used only in point-to-point applications.

#### 1.4 SUBMITTALS

- A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  2. See Specification Section 40 90 00.
  3. Product technical data:
    - a. As required by Specification Section 40 90 00.
    - b. Annotated hard copies of RTU software programs.
      - 1) Annotate program listing to include the following (as applicable):
        - a) Descriptive titles for all subroutine functions.
        - b) Reference to control loop numbers.
        - c) Reference to instrumentation and equipment tag numbers.
      - 2) Define all function blocks used in program.
      - 3) Provide listing of all addresses referenced in logic diagram with description of data associated with each address.
    - c. Arrangement drawings for RTU system components in accordance with Specification Section 40 98 00.
    - d. Panel and enclosure plans, sections and details in accordance with Specification Section 40 98 00.
    - e. Enclosure internal wiring and terminal blocks in accordance with Specification Section 40 98 00.
    - f. Manufacturer's installation instructions.
  4. Submit all catalog cut sheets under Specification Section 27 21 00 submittals.
  5. Submit all panel fabrication drawings and associated wiring diagrams for RTUs under Specification Section 40 98 00 submittals.
- B. Operation and Maintenance Manuals:
1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.
- C. Informational Submittals:
1. Radio site survey results including the following minimum information:
    - a. Electromagnetic noise level at each site.
    - b. Data rate for each radio.
    - c. Received radio signal strength at installed antenna height for each radio.

- d. Fade margin in dB (difference between weakest signal the radio can read and actual received signal strength).
2. List of all recommended spares for maintenance purposes with each item separately priced.
  - a. List shall include all special tools and test equipment necessary for the maintenance of the complete system.
3. Results of factory testing procedures.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

### **2.2 RTUS (REMOTE TERMINAL UNITS)**

- A. Acceptable Manufacturers:
  1. Allen-Bradley MicroLogix 1400.
  2. Approved Equal.
- B. Processor Design and Fabrication:
  1. Communication via radio to remote storage tank RTU.
  2. Communication ports:
    - a. As required to meet requirements of Contract Documents.
  3. Capable of being remotely programmed via radio.
  4. All application programming in IEC 61131-3 compliant language.
    - a. Program RTU utilizing ladder diagram programming language or approved equal.
    - b. Protect program via removable key switch or password to prevent unauthorized changes.
    - c. Capable of on-line and off-line programming.
  5. Memory:
    - a. Non-volatile program storage via flash EPROM.
  6. Environmental ratings:
    - a. Temperature: -40 DegF to 158 DegF.
    - b. Humidity: 5 to 95 percent non-condensing humidity range.
  7. Processor shall include diagnostic indicators for power, mode, low battery, communications ports, and memory and I/O errors.
  8. Input power: 120 Vac.
  9. Power supply sized to supply power to processor, I/O modules, and control loops.
- C. Inputs and Outputs:
  1. I/O modules shall be provided as required to accommodate the types and quantities of I/O points identified.
  2. Each I/O module shall include visible diagnostic indicators for point status (discrete points), fault condition, and active condition.
  3. I/O modules shall be capable of being replaced while under power.
  4. All I/O modules shall report to the CPU should a terminal block fail or be removed.
  5. Analog output modules shall have a minimum resolution of 12 bits.
  6. Provide electric isolation between logic and field device.
  7. Input and output modules shall be capable of withstanding low energy common mode transient to 1000 V without failure.
  8. Install 20 percent spare points for each module type.
  9. Discrete outputs shall be fused:
    - a. Provide one (1) fuse per common or per isolated output.
    - b. Provide blown fuse indication.

#### **D. Connection Requirements:**

1. Make connections to I/O subsystem by terminating all field wiring on terminal blocks within the I/O enclosure.
  2. Prewire I/O modules to terminal blocks.
  3. Field wiring shall not be disturbed when removing or replacing an I/O module.
  4. Provide terminations in accordance with requirements of Specification Section 40 98 00.
- E. Internal Panel Wiring: Provide internal panel wiring in accordance with requirements of Specification Section 40 98 00.
- F. Grounding Requirements: Provide grounding in accordance with requirements of Specification Section 40 98 00.
- G. Component Mounting and Placement: Provide in accordance with requirements of Specification Section 40 98 00.
- H. Environmental Controls: Provide environmental controls in accordance with requirements of Specification Section 40 98 00.
- I. Power Supply Units:
1. Provide regulated power units to provide power to:
    - a. All RTU components.
    - b. All I/O circuits not powered from the field.
    - c. Other devices as indicated on Drawings or Specifications.
  2. Provide power distribution as specified in Specification Section 40 98 00.
  3. Electrical service to RTU system is 105 to 125 V, 60 Hz, +/- 10 percent, 1 PH power.
  4. Size battery backup to maintain DC power for all DC power users for a minimum of 60 seconds upon the loss of AC power to ensure transient surges and dips do not affect the operation of the RTU.
- J. Internal Panel Lighting and Service Receptacles: Provide in accordance with requirements of Specification Section 40 98 00.
- K. Surge Protection:
1. Provide Type IC1 SPD (surge protection device) per Section 40 99 00 in the 120 Vac power supply circuit for the RTU.
  2. Provide Type IC3 or IC7 SPD (as applicable) per Section 40 99 00 in all discrete output signal circuits.
  3. Provide Type IC5 SPD in the control panel for each analog input per Section 40 99 00.
  4. Type IC6 SPD at each 120 Vac powered 4-wire analog device with 4-20 mA signal per Section 40 99 00.
- L. RTU Enclosure:
1. Furnish enclosures in accordance with all requirements of Specification Section 40 98 00.
    - a. Enclosures shall meet all requirements of UL 508A.
- M. RTU Software and Programming:
1. Provide all hardware and programming required to accomplish the control requirements of the loop descriptions, Drawings, and Specifications.
  2. Provide two (2) copies of fully documented control logic program on CD.
  3. Programming software shall be directly supported by RTU manufacturer.
  4. Copies of all software utilized for programming RTU or associated components (e.g., radios and/or microprocessor based flat panels) shall be licensed to the Owner.
  5. On/off line programming.
  6. Two (2) step commands requiring operator verification prior to deletion of any programming.

## **2.3 WIRELESS I/O RADIOS**

- A. Acceptable Manufacturers:
1. OMNEX Controls.
  2. Phoenix Contact Wireless I/O.

- 1 3. Elpro Technologies.
- 2 B. Design and Fabrication:
- 3 1. Transmission of data:
- 4 a. Type: Hardwired Inputs, Serial Output.
- 5 b. Serial protocol: Modbus RTU.
- 6 c. Serial communication:
- 7 1) As required to meet communication requirements of Contract Documents.
- 8 d. Data throughput: 19.2 Kbps.
- 9 2. Range:
- 10 a. Up to 600 to 1000 FT without line-of-sight.
- 11 b. Up to 4 to 5 miles with line-of-sight.
- 12 c. Up to 15 miles with a raised, 6dB gain antenna.
- 13 3. License free, frequency hopping spread spectrum.
- 14 4. Frequency: 902-928 MHz.
- 15 5. Provided with a whip antenna and 6 FT (Minimum) of flexible coaxial antenna cable for
- 16 each radio.
- 17 a. The antenna and cable supplied shall provide the ranges of transmission as listed in
- 18 Paragraphs 2.3B.2.a. and b.
- 19 b. Antenna type as indicated on the Drawings:
- 20 1) Yagi antenna for point-to-point applications.
- 21 2) Omnidirectional antenna for point-to-multipoint or multipoint-to-multipoint
- 22 applications.
- 23 6. Diagnostics:
- 24 a. Provide capability for remote diagnostics monitoring.
- 25 1) Provide licensed copies to the Owner of any software required for remote
- 26 diagnostics.
- 27 7. Configuration:
- 28 a. Provide remote configuration capability.
- 29 1) Provide licensed copies to the Owner of any software required for remote
- 30 configuration.
- 31 8. Error detection/correction: 16 bit CRC with ARQ (Automatic Re-send Query).
- 32 9. Output accuracy: 0.2 percent of full scale.
- 33 10. Temperature: -40 to +158 DegF.
- 34 11. Humidity: 90 percent at 104 DegF noncondensing.
- 35 12. Input power: 10.5-24 Vdc.
- 36 13. Case: Aluminum.
- 37 14. Agency approvals: FCC 47 CFR 15.247.

## 38 2.4 ANTENNAS, TOWERS AND MASTS

- 39 A. Design and Fabrication:
- 40 1. All steel antenna towers and supporting structures shall be in accordance with
- 41 TIA/EIA/ANSI 222-G.
- 42 2. Lightning protected: Mast or tower direct connected to ground.
- 43 3. Provide all masts, supports, lightning suppressors, and other apparatus required to make a
- 44 complete and operable radio telemetry system.

## 45 2.5 ACCESSORIES

- 46 A. Provide all accessories required to furnish a complete telemetry system to accomplish the
- 47 requirements of the Drawings and Specifications.

## 48 2.6 SOURCE QUALITY CONTROL

- 49 A. Provide a performance test after factory completion and prior to shipment.
- 50 1. Conduct a test where the RTU is operated continuously and checked for correct operation.
- 51 2. Conduct testing with dummy I/O's to verify each control loop operation.
- 52 3. Allow for Owner and Engineer representatives to witness testing program.

- 1 a. Provide minimum of 15 days notice prior to testing.
- 2 4. Do not ship prior to successful completion of this testing program.

## 3 2.7 MAINTENANCE MATERIALS

- 4 A. Furnish Owner with the following extra materials:
  - 5 1. One (1) spare I/O card of each card type for every 10 cards or fraction thereof installed.
  - 6 2. One (1) spare RTU processor of each type installed.
  - 7 3. One (1) spare power supply of each type for every 10 power supplies or fraction thereof
  - 8 installed.
  - 9 4. One (1) spare radio of each type installed.

## 10 PART 3 - EXECUTION

### 11 3.1 INSTALLATION

- 12 A. Install telemetry system as shown on Drawings in accordance with manufacturer's written
- 13 instruction.
- 14 B. Provide documentation verifying the data communication rate (actual throughput), signal
- 15 strength and signal quality for each radio.

### 16 3.2 FIELD QUALITY CONTROL

- 17 A. Conduct startup of equipment and perform operational checks.
- 18 B. Maintain and submit an accurate daily or weekly log of all commissioning and startup functions.
  - 19 1. All commissioning/startup functions may be witnessed by the Engineer.
  - 20 2. All reports shall be signed and dated by the Contractor.
- 21 C. Provide Owner with a written statement that equipment has been installed properly, started up,
- 22 and is ready for operation by Owner's personnel.

### 23 3.3 DEMONSTRATION

- 24 A. Demonstrate system in accordance with Specification Section 01 75 00.

### 25 3.4 TRAINING

- 26 A. On-site Training:
  - 27 1. Provide employee of the manufacturer or certified representative to provide 2 days of
  - 28 operation and maintenance training at the Project site after the system has successfully
  - 29 undergone all field testing and acceptance procedures.
    - 30 a. As a minimum, training shall cover:
      - 31 1) Hardware overview.
      - 32 2) Software overview.
      - 33 3) Maintenance.
      - 34 4) Troubleshooting.
      - 35 5) Operation, e.g., changing set points, passwords, etc.

36 **END OF SECTION**

**SECTION 31 10 00**  
**SITE CLEARING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Site clearing, tree protection, stripping topsoil and demolition.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
  3. Section 31 23 00 - Earthwork.
  4. Section 32 91 05 - Topsoiling and Finished Grading.
  5. Section 31 25 00 - Soil Erosion and Sediment Control.

**PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)**

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Protect existing trees and other vegetation to remain against damage.
1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
  2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
  3. Provide temporary protection as required.
- B. Repair or replace trees and vegetation damaged by construction operations.
1. Repair to be performed by a qualified tree surgeon.
  2. Remove trees which cannot be repaired and restored to full-growth status.
  3. Replace with new trees of minimum 4 IN caliper.
- C. Owner will obtain authority for removal and alteration work on adjoining property.

**3.2 SITE CLEARING**

- A. Topsoil Removal:
1. Strip topsoil to depths encountered.
    - a. Remove heavy growths of grass before stripping.
    - b. Stop topsoil stripping sufficient distance from such trees to prevent damage to main root system.
    - c. Separate from underlying subsoil or objectionable material.
  2. Stockpile topsoil where directed by Engineer.
    - a. Construct storage piles to freely drain surface water.
    - b. Seed or cover storage piles to prevent erosion.
  3. Do not strip topsoil in wooded areas where no change in grade occurs.
  4. Borrow topsoil: Reasonably free of subsoil, objects over 2 IN DIA, weeds and roots.
- B. Clearing and Grubbing:
1. Clear from within limits of construction all trees not marked to remain.
    - a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.



## SECTION 31 21 33

### TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Excavation, trenching, backfilling and compacting for all underground utilities.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Division 26 - Electrical.
  - 4. Section 31 23 00 - Earthwork.
  - 5. Section 33 05 16 - Precast Concrete Manhole Structures.

##### 1.2 QUALITY ASSURANCE

- A. Referenced Standards:
  - 1. ASTM International (ASTM):
    - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
    - b. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
    - c. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
    - d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
    - e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

##### 1.3 DEFINITIONS

- A. Excavation: All excavation will be defined as unclassified.

##### 1.4 SUBMITTALS

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's installation instructions.
  - 3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
  - 4. Submit sieve analysis reports on all granular materials.
- B. Informational Submittals:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Trench shield (trench box) certification if employed:
    - a. Specific to Project conditions.
    - b. Re-certified if members become distressed.

- c. Certification by registered professional structural engineer, registered in the state where the Project is located.
- d. Engineer is not responsible to, and will not, review and approve.

## 1.5 PROJECT CONDITIONS

- A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
  1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.
- B. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
- C. Verify location of existing underground utilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Backfill Material:
  1. As approved by Engineer.
    - a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
    - b. Moisture content at time of placement: 3 percent plus/minus of optimum moisture content as specified in accordance with ASTM D1557.
  2. Gravel trench backfill materials:
    - a. Uniformly graded pea gravel defined below:

Sieve Size	6	4	1	No. 4	No. 200
Percent Passing by Weight	100	-	-	50-100	5 max
Percent Passing by Weight	-	100	-	50-100	5 max
Percent Passing by Weight	-	-	100	50-100	5 max

- B. Subgrade Stabilization Materials: Provide subgrade stabilization material consisting of 6-inch minus pit run granular free draining fill or other approved granular soil.

- C. Bedding Materials:
  1. Compacted, granular pipe bedding should be provided in accordance with the pipe manufacturer's recommendations or for a depth of at least 8 inches above and below underground utility pipes to distribute vertical loads and to protect the pipe during backfill and compaction operations. The pipe bedding should be rounded and have a maximum particle size of 3/4-inch and a maximum of 5 percent passing the No. 200 sieve.
  2. As approved by the Soils Engineer.
  3. Granular bedding materials:
    - a. ASTM C33, gradation 67 (3/4 IN to No. 4 sieve) defined below:

Sieve Size	1 IN	3/4 IN	3/8 IN	No. 4	No. 20
Percent Passing by Weight	100	90-100	20-55	0-10	0

4. Flowable fill:
  - a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
  - b. Material characteristics:
    - 1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
      - a) Cement (Type I or II): 50 LBS.
      - b) Fly ash: 200 LBS.

- c) Fine sand: 2,700 LBS.
- d) Water: 420 LBS.
- e) Air content: 10 percent.
- 2) Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
- 3) Approximate compressive strength should be 85 to 175 psi.
- 4) Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.
- 5) Mixing and handling of the material shall be in accordance with Specification Section 03 31 31.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Remove and dispose of unsuitable materials.

### **3.2 EXCAVATION**

- A. All excavation is Unclassified. No separate payment will be made for rock excavation.
  - 1. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Soils Engineer.
- B. Excavation for Appurtenances:
  - 1. 12 IN (minimum) clear distance between outer surface and embankment.
  - 2. See Specification Section 31 23 00 for applicable requirements.
  - 3. See Specification Section 33 05 16 for applicable requirements.
- C. Groundwater Dewatering:
  - 1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow subgrade stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
  - 2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.
  - 3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
    - a. Employ dewatering specialist for selecting and operating dewatering system.
  - 4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
  - 5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
  - 6. Install groundwater monitoring wells as necessary.
  - 7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
  - 8. Cost of groundwater dewatering shall be considered incidental to the contract. No additional payment shall be made.
- D. Trench Excavation:
  - 1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
    - a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
      - 1) Stabilize excavation to prevent undermining of existing utility and yard piping.
  - 2. Open trench outside buildings, units, and structures:
    - a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
    - b. Field adjust limitations as weather conditions dictate.

3. Trenching within buildings, units, or structures:
  - a. No more than 100 LF at any one time.
4. Any trench or portion of trench, which is opened as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
  - a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
5. Observe following trenching criteria:
  - a. Trench size:
    - 1) Excavate width to accommodate free working space.
    - 2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN
more than 33 IN	24 IN

- 3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
- 4) Keep trenches free of surface water runoff.
  - a) Include cost in Bid.
  - b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:

1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
2. Modify for electrical installations as follows:
  - a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
  - b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
  - c. Do not over excavate trench.
  - d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
  - e. See Division 26 for additional requirements.

F. Flowable Fill:

1. Flowable fill shall be:
  - a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
  - b. Placed in 4 FT maximum lifts to the elevations indicated.
    - 1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
    - 2) Contractor shall place flowable fill lifts in such a manner as to prevent flotation of the pipe.
2. Flowable fill shall not be placed on frozen ground.
3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
4. Conform to appropriate requirements of Specification Section 31 23 00.
5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DegF and rising.
6. At the time of placement, flowable fill must have a temperature of at least 40 DegF.
7. Mixing and placing shall stop when the air temperature is 38 DegF or less and falling.
8. Each filling stage shall be as continuous an operation as is practicable.
9. Contractor shall prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.

- 1           10. Flowable fill shall not be placed until water has been controlled or groundwater level has  
2           been lowered in conformance with the requirements of the preceding Groundwater  
3           Dewatering paragraph in PART 3 of this Specification Section.

### 4   **3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING**

- 5   A. Over-Excavation:  
6       1. Backfill and compact to 90 percent of maximum dry density per ASTM D698.  
7       2. Backfill with granular bedding material as option.
- 8   B. Rock Excavation:  
9       1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.  
10       2. Backfill to grade with suitable earth or granular material.  
11       3. Form bell holes in trench bottom.
- 12   C. Subgrade Stabilization:  
13       1. Stabilize the subgrade when directed by the Owner.  
14       2. Observe the following requirements when unstable trench bottom materials are encountered.  
15           a. Notify Owner when unstable materials are encountered.  
16               1) Define by drawing station locations and limits.  
17           b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or  
18           Contractor operations.  
19               1) Replace with subgrade stabilization with no additional compensation.

### 20   **3.4 BACKFILLING METHODS**

- 21   A. Do not backfill until tests to be performed on system show system is in full compliance to  
22   specified requirements.
- 23   B. Carefully Compacted Backfill:  
24       1. Furnish where indicated on Drawings, specified for trench embedment conditions and for  
25       compacted backfill conditions up to 12 IN above top of pipe or conduit.  
26       2. Comply with the following:  
27           a. Place backfill in lifts not exceeding 8 IN (loose thickness).  
28           b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.  
29           c. Observe specific manufacturer's recommendations regarding backfilling and  
30           compaction.  
31           d. Compact each lift to specified requirements.
- 32   C. Common Trench Backfill:  
33       1. Perform in accordance with the following:  
34           a. Place backfill in lift thicknesses capable of being compacted to densities specified.  
35           b. Observe specific manufacturer's recommendations regarding backfilling and  
36           compaction.  
37           c. Avoid displacing joints and appurtenances or causing any horizontal or vertical  
38           misalignment, separation, or distortion.
- 39   D. Water flushing for consolidation is not permitted.
- 40   E. Backfilling for Electrical Installations:  
41       1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench  
42       Backfill paragraph in PART 3 of this Specification Section or when approved by the  
43       Engineer.  
44       2. Modify for electrical installation as follows:  
45           a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct  
46           burial cables.

### 47   **3.5 COMPACTION**

- 48   A. General:

1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
2. In no case shall degree of compaction below minimum compactions specified be accepted.

**B. Compaction Requirements:**

1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.
  - a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	95 percent per ASTM D1557

- b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	95 percent of maximum dry density by and ASTM D1557

- c. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	95 percent of maximum dry density by ASTM D1557
	Cohesionless soils	95 percent of relative density by ASTM D1557
Under turfed, sodded, plant seeded, nontraffic areas	Cohesive soils	90 percent of maximum dry density by ASTM D1557
	Cohesionless soils	95 percent of relative density by ASTM D1557

### 3.6 FIELD QUALITY CONTROL

**A. Testing:**

1. Perform in-place moisture-density tests as directed by the Owner.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Costs of "Passing" tests paid by Owner.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Specification Section will imply Soils Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure Owner has immediate access for testing of all soils related work.
8. Ensure excavations are safe for testing personnel.

## END OF SECTION

**SECTION 31 23 00**  
**EARTHWORK**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Earthwork.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. ASTM International (ASTM):
    - a. C33, Standard Specification for Concrete Aggregates.
    - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>).
    - c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m)).
    - d. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method.
    - e. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
    - f. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
    - g. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's installation instructions.
  - 3. Certifications.
  - 4. Test reports:
    - a. Soils inspection and testing results.
- B. Samples:
  - 1. Submit samples and source of fill and backfill materials proposed for use.
  - 2. Submit samples and source of borrow materials proposed for use.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Fill and Backfill: Selected material approved by Soils Engineer from site excavation or from off site borrow.
- B. Granular Fill Under Building Floor Slabs-On-Grade: Clean, crushed, nonporous rock, crushed or uncrushed gravel complying with ASTM C33 gradation size No. 67, 3/4 IN to No. 4.

- C. Granular Fill Under Base Slabs with Pressure Relief Valves:
  - 1. Drainage material: Conform to ASTM C33, Size No. 67.
  - 2. Filter material: Conform to ASTM C33 requirements for fine aggregate.
- D. Geotextile Filter Fabric:
  - 1. Nonwoven type.
  - 2. Equivalent opening size: 50-100 (U.S. Standard Sieve).
  - 3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
  - 4. Grab strength: 90 LBS minimum in either direction in accordance with ASTM D4632 requirements.
  - 5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.
- E. Vapor Barrier: Refer to Specification Section 07 26 00.

## **PART 3 - EXECUTION**

### **3.1 PROTECTION**

- A. Protect existing surface and subsurface features on-site and adjacent to site as follows:
  - 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
  - 2. Protect and maintain bench marks, monuments or other established reference points and property corners.
    - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
  - 3. Verify location of utilities.
    - a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
    - b. Secure and examine local utility records for location data.
    - c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
    - d. Repair damages to utility items at own expense.
    - e. In case of damage, notify Engineer at once so required protective measures may be taken.
  - 4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
    - a. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
    - b. All repairs to be made and paid for by Contractor.
  - 5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
  - 6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
  - 7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.
- B. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.
- C. Dispose of waste materials, legally, off site.
  - 1. Burning, as a means of waste disposal, is not permitted.

### **3.2 SITE EXCAVATION AND GRADING**

- A. The work includes all operations in connection with excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.
- B. Excavation and Grading:

1. All excavation is unclassified. No separate payment shall be made for rock excavations.
  2. Perform as required by the Contract Drawings.
  3. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
    - a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
    - b. Perform other layout work required.
    - c. Replace property corner markers to original location if disturbed or destroyed.
  4. Preparation of ground surface for embankments or fills:
    - a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.
    - b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
  5. Protection of finish grade:
    - a. During construction, shape and drain embankment and excavations.
    - b. Maintain ditches and drains to provide drainage at all times.
    - c. Protect graded areas against action of elements prior to acceptance of work.
    - d. Reestablish grade where settlement or erosion occurs.
- C. Borrow:
1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
  2. Include cost of all borrow material in original proposal.
  3. Fill material to be approved by Soils Engineer prior to placement.
- D. Construct embankments and fills as required by the Contract Drawings:
1. Construct embankments and fills at locations and to lines of grade indicated.
    - a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
  2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
    - a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
    - b. Do not place material in layers greater than 8 IN loose thickness.
    - c. Place layers horizontally and compact each layer prior to placing additional fill.
  3. Compact by sheep'sfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
    - a. Control moisture for each layer necessary to meet requirements of compaction.

### **3.3 ROCK EXCAVATION**

- A. All excavation is Unclassified. No separate payment shall be made for rock excavation. All rock excavation shall be under one classification.
1. This classification shall include solid ledge rock in its natural location that requires systematic quarrying, drilling and/or blasting for its removal and also boulders that exceed 1/2 CY in volume.
- B. When rock is encountered, strip free of earth.
- a. For structures: 3 FT outside the exterior limits of foundations and from rock surface to 6 IN below bottom of foundations.
  - b. For piping and utilities: A width 18 IN wider than the outside diameter of the pipe or conduit and from rock surface to 6 IN below bottom exterior surface of the pipe or conduit.
  - c. For paving: 2 FT outside the exterior limits of paving and from rock surface to 6 IN below bottom of pavement subbase.

**3.4 USE OF EXPLOSIVES**

- A. Blasting with any type of explosive is prohibited.

**3.5 FIELD QUALITY CONTROL**

- A. Moisture density relations, to be established by the Soils Engineer required for all materials to be compacted.
- B. Extent of compaction testing will be as necessary to assure compliance with specifications.
- C. Give minimum of 24 HR advance notice to Soils Engineer when ready for compaction or subgrade testing and inspection.
- D. Should any compaction density test or subgrade inspection fail to meet specification requirements, perform corrective work as necessary.
- E. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

**3.6 COMPACTION DENSITY REQUIREMENTS**

- A. Obtain approval from Soils Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Provide dewatering system necessary to successfully complete compaction and construction requirements.
- C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Soils Engineer.
- D. Stabilize subgrade with well graded granular materials as directed by Soils Engineer.
- E. Assure by results of testing that compaction densities comply with the following requirements:
1. Sitework:

LOCATION	COMPACTION DENSITY
Under Paved Areas, Sidewalks and Piping:	
Cohesive soils	100 percent per ASTM D698
Cohesionless soils	75 percent relative density per ASTM D4253 and ASTM D4254
Unpaved Areas:	
Cohesive soils	85 percent of ASTM D698
Cohesionless soils	60 percent relative density per ASTM D4253 and ASTM D4254

2. Structures:

LOCATION	COMPACTION DENSITY
Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material	95 percent per ASTM D1557
Outside structures next to walls, piers, columns and any other structure exterior member	90 percent per ASTM D1557

3. Specific areas:

LOCATION	COMPACTION DENSITY
Outside structures under equipment support foundations	95 percent per ASTM D1557
Under void	85 percent per ASTM D1557
Granular fill under base slabs with pressure relief valves, and under building floor slabs-on-grade	75 percent relative density per ASTM D4253 and ASTM D4254

### 3.7 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

#### A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.
  - a. Materials and source to be approved by Soils Engineer.
  - b. Excavated material approved by Soils Engineer may also be used for fill and backfill.
3. In this Specification Section, the word "foundations" includes footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil.
4. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

#### B. Excavation Requirements for Structures:

1. General:
  - a. Do not commence excavation for foundations for structures until Soils Engineer approves:
    - 1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
    - 2) Density and moisture content of site area compacted fill material meets requirements of specifications.
    - 3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
    - 4) Surcharge or mass fill material has been removed from construction area or portions thereof.
  - b. Engineer grants approval to begin excavations.
2. Dimensions:
  - a. Excavate to elevations and dimensions indicated or specified.
  - b. Allow additional space as required for construction operations and inspection of foundations.
3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
  - a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Soils Engineer.
4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
  - a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
  - b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 IN and then compact to density stated in this Specification Section before fill material can be placed thereon.

- c. Do not carry excavations lower than shown for foundations except as directed by Soils Engineer or Engineer.
- d. If any part of excavations is carried below required depth without authorization, maintain excavation and start foundation from excavated level with concrete of same strength as required for superimposed foundation, and no extra compensation will be made to Contractor therefore.
5. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.
6. Notify Soils Engineer and Engineer as soon as excavation is completed in order that subgrades may be inspected.
  - a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Soils Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
  - b. Soils Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
  - c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
  - d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
7. Dewatering:
  - a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
  - b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.
  - c. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
  - d. Employ dewatering specialist for selecting and operating dewatering system.
  - e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
  - f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
    - 1) Install groundwater monitoring wells as necessary.
  - g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Subgrade stabilization:
  - a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Soils Engineer.
  - b. Provide compaction density of replacement material as stated in this Specification Section.
  - c. Loose, wet, or soft materials, when approved by Soils Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
  - d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
  - e. Remove and replace frozen materials as directed by Soils Engineer.
  - f. Method of stabilization shall be performed as directed by Soils Engineer.
  - g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Soils Engineer.

9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
  - a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF before structure is completed and heated to a temperature of at least 50 DegF.
10. Protection of structures:
  - a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
  - b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
11. Shoring:
  - a. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.
  - b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
12. Drainage:
  - a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
  - b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
  - c. Provide pumping required to keep excavated spaces clear of water during construction.
  - d. Should any water be encountered in the excavation, notify Engineer and Soils Engineer.
  - e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
13. Frost protection:
  - a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
  - b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
  - c. Protect excavation from frost if placing of concrete or fill is delayed.
  - d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
  - e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DegF.
- C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:
  1. General:
    - a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Soils Engineer and scarified to a depth of 6 IN and compacted to density specified herein.
    - b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 percent.
    - c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Soils Engineer as being free of undesirable material and compacted to specified density.
  2. Obtain approval of fill and backfill material and source from Soils Engineer prior to placing the material.
  3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.

4. Vapor barrier: Install a continuous vapor barrier under floor slabs-on-grade as required by Specification Section 07 26 00 and shown on Contract Drawings.
  5. Fill and backfill placement:
    - a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Soils Engineer.
    - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
    - c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
    - d. Use hand operated equipment for filling and backfilling next to walls.
    - e. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
    - f. Use vibratory equipment to compact granular material; do not use water.
  6. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content, outside the exterior limits of foundations located around perimeter of structure the following horizontal distance whichever is greater:
    - a. As required to provide fill material to indicated finished grade.
    - b. 5 FT.
    - c. Distance equal to depth of compacted fill below bottom of foundations.
    - d. As directed by Soils Engineer.
- D. Filling and Backfilling Outside of Structures.
1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
  2. Provide material as approved by Soils Engineer for filling and backfilling outside of structures.
  3. Fill and backfill placement:
    - a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Soils Engineer.
    - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
    - c. Compact material with equipment of proper type and size to obtain density specified.
    - d. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
    - e. Do not place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.
    - f. Use vibratory equipment for compacting granular material; do not use water.
  4. Backfilling against walls:
    - a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
    - b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.
    - c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
    - d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.
- E. Backfilling Outside of Structures Under Piping or Paving:
1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
  2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.

3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

### 3.8 SPECIAL REQUIREMENTS

### A. Erosion Control:

1. Conduct work to minimize erosion of site.
2. Construct stilling areas to settle and detain eroded material.
3. Remove eroded material washed off site.
4. Clean streets daily of any spillage of dirt, rocks or debris from equipment entering or leaving site.

**END OF SECTION**



**SECTION 32 91 05**  
**TOPSOILING AND FINISHED GRADING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Topsoiling and finished grading.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 31 10 00 - Site Clearing.
  - 4. Section 31 23 00 - Earthwork.
  - 5. Section 31 25 00 - Soil Erosion and Sediment Control.
  - 6. Section 32 90 00 - Seeding, Sodding and Landscaping.
- C. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Project Data: Test reports for furnished topsoil.

**1.3 SITE CONDITIONS**

- A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Topsoil:
  - 1. Original surface soil typical of the area.
  - 2. Existing topsoil stockpiled under Specification Section 31 10 00.
  - 3. Capable of supporting native plant growth.

**2.2 TOLERANCES**

- A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Correct, adjust and/or repair rough graded areas.
  - 1. Cut off mounds and ridges.
  - 2. Fill gullies and depressions.
  - 3. Perform other necessary repairs.
  - 4. Bring all sub-grades to specified contours, even and properly compacted.

- 1 B. Loosen surface to depth of 2 IN, minimum.
- 2 C. Remove all stones and debris over 2 IN in any dimension.
- 3 **3.2 ROUGH GRADE REVIEW**
- 4 A. Reviewed by Engineer in Specification Section 31 10 00.
- 5 **3.3 PLACING TOPSOIL**
- 6 A. Do not place when subgrade is wet or frozen enough to cause clodding.
- 7 B. Spread to compacted depth of 4 IN for all disturbed earth areas.
- 8 C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to
- 9 Owner.
- 10 D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.
- 11 E. Provide finished surface smooth and true to required grades.
- 12 F. Restore stockpile area to condition of rest of finished work.
- 13 **3.4 ACCEPTANCE**
- 14 A. Upon completion of topsoiling, obtain Engineer's acceptance of grade and surface.
- 15 B. Make test holes where directed to verify proper placement and thickness of topsoil.

16 **END OF SECTION**

**SECTION 33 05 16**  
**PRECAST CONCRETE MANHOLE STRUCTURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Precast concrete manhole structures and appurtenant items.
    - a. Sanitary sewer manholes and appurtenances.
    - b. Drain manholes and appurtenances.
    - c. Storm sewer manholes and appurtenances.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
  - 4. Section 09 91 00 - Painting and Protective Coatings.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. ASTM International (ASTM):
    - a. A48, Standard Specification for Gray Iron Castings.
    - b. C150, Standard Specification for Portland Cement.
    - c. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
    - d. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
    - e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
    - f. D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's installation instructions.
  - 3. Fabrication and/or layout drawings:
    - a. Include detailed diagrams of manholes showing typical components and dimensions, reinforcements and other details.
    - b. Itemize, on separate schedule, sectional breakdown of each manhole structure with all components and refer to drawing identification number or notation.
    - c. Indicate knockout elevations for all piping entering each manhole.
- B. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. Manhole rings, covers and frames:
    - a. Neenah Foundry.

- 1 b. Deeter Foundry.
- 2 2. Black mastic joint compound:
- 3 a. Kalktite 340.
- 4 b. Tufflex.
- 5 c. Plastico.
- 6 3. Premolded joint compound:
- 7 a. Ram Nec.
- 8 b. Kent Seal.
- 9 4. Emulsified fibrated asphalt compound:
- 10 a. Sonneborn Hydrocide 700B Semi-Mastic.
- 11 B. Submit request for substitution in accordance with Specification Section 01 25 13.
- 12 **2.2 SANITARY SEWER, STORM AND DRAIN MANHOLE STRUCTURE COMPONENTS**
- 13 A. Manhole Components:
- 14 1. Reinforcement: ASTM C478.
- 15 2. Minimum wall thickness: 5 IN.
- 16 3. Minimum base thickness: 12 IN.
- 17 4. Provide the following components for each manhole structure:
- 18 a. Base (precast) with integral bottom section or (cast-in-place).
- 19 b. Precast bottom section(s).
- 20 c. Precast barrel section(s).
- 21 d. Precast eccentric transition section.
- 22 e. Precast adjuster ring(s).
- 23 f. Precast concrete transition section.
- 24 g. Precast flat top.
- 25 5. Unless dimensioned or specifically noted on Drawings, provide manhole section with
- 26 minimum 48 IN inside dimensions.
- 27 B. Special Coatings and Joint Treatment:
- 28 1. Joints of precast sections:
- 29 a. Black mastic compound: ASTM D4586.
- 30 2. Aluminum components embedded in concrete:
- 31 a. See Specification Section 09 91 00 for protective coating for aluminum embedded in
- 32 concrete.
- 33 3. Vertical wall surfaces:
- 34 a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type I for all exterior
- 35 and interior vertical wall surfaces.
- 36 C. Sanitary Sewer Manhole Concrete:
- 37 1. Provide all sanitary manholes constructed with Portland ASTM C150, Type I or II cement
- 38 with a tricalcium aluminate content not to exceed 8 percent.
- 39 2. Mix aggregate shall be a minimum of 50 percent crushed limestone.
- 40 3. Provide 3000 psi nonshrink grout.

## **PART 3 - EXECUTION**

### **3.1 MANHOLE CONSTRUCTION**

- 44 A. General:
- 45 1. Construct cast-in-place concrete base slabs.
- 46 2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent
- 47 sewer sections.
- 48 3. On all straight runs, lay pipe through manhole and cut out top half of pipe.
- 49 a. See detail on Drawings.
- 50 b. If pipes deflect at manhole, shape as specified in Paragraphs 2 and 4.

- 1           4. Shape inverts accurately and steel trowel finish.  
2           a. For changes in direction of the sewer and entering branches into the manhole, make a  
3           circular curve in the manhole invert using as large a radius as manhole inside diameter  
4           will permit.  
5           b. Pour base slab integral with bottom barrel section.
- 6       B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built  
7       into wall of manhole will be true extensions of line of pipe.
- 8       C. For all horizontal mating surfaces between concrete and concrete or concrete and metal, above  
9       established high groundwater elevation shown trowel apply to clean surface black mastic joint  
10       compound to a minimum wet thickness of 1/4 IN immediately prior to mating the surfaces.
- 11       D. For horizontal joints that fall below established high groundwater elevation shown, install a  
12       resilient O-ring type gasket or pre-molded joint compound.
- 13       E. Seal all pipe penetrations in manhole.  
14           1. Form pipe openings smooth and well shaped.  
15           2. After installation, seal cracks with, non shrink grout.  
16           3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt  
17           compound to minimum wet thickness of 1/8 IN to ensure complete seal.
- 18       F. Set and adjust frame and cover final 6 IN (minimum) to 18 IN (maximum) to match finished  
19       pavement or finished grade elevation using precast adjuster rings.

20

**END OF SECTION**



**SECTION 40 05 05**  
**EQUIPMENT: BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Requirements of this Specification Section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Specification Sections.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 09 00 - Concrete.
4. Section 05 50 00 - Metal Fabrications.
5. Section 09 91 00 - Painting and Protective Coatings.
6. Section 10 14 00 - Identification Devices.
7. Division 26 - Electrical.
8. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.
9. Section 40 91 10 - Primary Elements and Transmitters.

**1.2 QUALITY ASSURANCE**

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
2. American Gear Manufacturers Association (AGMA).
3. ASTM International (ASTM):
  - a. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
4. International Electrotechnical Commission (IEC).
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
6. National Electrical Manufacturers Association (NEMA):
  - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - b. ICS 6, Enclosures for Industrial Control and System.
  - c. MG 1, Motors and Generators.
7. National Fire Protection Association (NFPA):
  - a. 70, National Electrical Code (NEC):
    - 1) Article 430, Motors, Motor Circuits, and Controllers.
8. Occupational Safety and Health Administration (OSHA):
  - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
9. Underwriters Laboratories, Inc. (UL).
  - a. 508, Standard for Safety Industrial Control Equipment.
  - b. 508A, Standard for Safety Industrial Control Panels.

B. Miscellaneous:

1. A single manufacturer of a "product" to be selected and utilized uniformly throughout Project even though:
  - a. More than one (1) manufacturer is listed for a given "product" in Specifications.
  - b. No manufacturer is listed.
2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Drawings.

### 1.3 DEFINITIONS

- A. Product: Manufactured materials and equipment.
- B. Major Equipment Supports - Supports for Equipment:
  - 1. Located on or suspended from elevated slabs with supported equipment weighing 2000 LBS or greater, or;
  - 2. Located on or suspended from roofs with supported equipment weighing 500 LBS or greater, or;
  - 3. Located on slab-on-grade or earth with supported equipment weighing 5000 LBS or more.
- C. Equipment:
  - 1. One (1) or more assemblies capable of performing a complete function.
  - 2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
  - 3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.
- D. Installer or Applicator:
  - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
  - 2. Installer and applicator are synonymous.

### 1.4 SUBMITTALS

- A. Shop Drawings:
  - 1. General for all equipment:
    - a. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
    - b. Data sheets that include manufacturer's name and complete product model number.
      - 1) Clearly identify all optional accessories that are included.
    - c. Acknowledgement that products submitted comply with the requirements of the standards referenced.
    - d. Manufacturer's delivery, storage, handling, and installation instructions.
    - e. Equipment identification utilizing numbering system and name utilized in Drawings.
    - f. Equipment installation details:
      - 1) Location of anchorage.
      - 2) Type, size, and materials of construction of anchorage.
      - 3) Anchorage setting templates.
      - 4) Manufacturer's installation instructions.
    - g. Equipment area classification rating.
    - h. Shipping and operating weight.
    - i. Equipment physical characteristics:
      - 1) Dimensions (both horizontal and vertical).
      - 2) Materials of construction and construction details.
    - j. Equipment factory primer and paint data.
    - k. Manufacturer's recommended spare parts list.
    - l. Equipment lining and coatings.
    - m. Equipment utility requirements include air, natural gas, electricity, and water.
    - n. Ladders and platforms provided with equipment:
      - 1) Certification that all components comply fully with OSHA requirements.
      - 2) Full details of construction/fabrication.
      - 3) Scaled plan and sections showing relationship to equipment.
  - 2. Mechanical and process equipment:
    - a. Operating characteristics:
      - 1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
      - 2) Brake horsepower requirements.

- 3) Copies of equipment data plates.
  - b. Piping and duct connection size, type and location.
  - c. Equipment bearing life certification.
  - d. Equipment foundation data:
    - 1) Equipment center of gravity.
    - 2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.
  3. Electrical and control equipment:
    - a. Electric motor information:
      - 1) Documentation showing that motors provided are "NEMA Premium" energy efficient type and not standard efficiency motors.
        - a) When standard efficiency motors are submitted, provide documentation why "NEMA Premium" efficient motors are not available.
      - 2) Motor manufacturer and model number.
      - 3) Rated voltage and frequency.
      - 4) Number of phases.
      - 5) Rated full load speed.
      - 6) Insulation system class and rated temperature rise at nameplate horsepower.
      - 7) Time rating: 5, 15, 30 or 60 minutes or continuous.
      - 8) Rated HP.
      - 9) Locked-Rotor Indicating Code Letter or actual locked rotor current.
      - 10) Motor service factor.
      - 11) Motor enclosure type.
      - 12) NEMA frame size.
      - 13) NEMA design code.
      - 14) Current, efficiency and power factor at 1/2, 3/4 and full load.
      - 15) Space heater data, if applicable.
      - 16) Type of bearings and lubrication.
      - 17) Net weight.
      - 18) Motor thermostat, RTD, or thermistor data, if applicable.
      - 19) Motor test reports, where applicable.
      - 20) Motor conduit box data.
    - b. Control panels:
      - 1) Panel construction.
      - 2) Point-to-point ladder diagrams.
      - 3) Scaled panel face and subpanel layout.
      - 4) Technical product data on panel components.
      - 5) Panel and subpanel dimensions and weights.
      - 6) Panel access openings.
      - 7) Nameplate schedule.
      - 8) Panel anchorage.
  4. Systems schematics and data:
    - a. Provide system schematics where required in system specifications.
      - 1) Acknowledge all system components being supplied as part of the system.
      - 2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
      - 3) Provide technical data for each system component showing compliance with the Contract Document requirements.
      - 4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.
  5. For factory painted equipment, provide paint submittals in accordance with Specification Section 09 91 00.
- B. Operation and Maintenance Manuals:
1. See Specification Section 01 3304 for requirements for:
    - a. The mechanics and administration of the submittal process.

- 1                   b. The content of Operation and Maintenance Manuals.
- 2       C. Informational Submittals:
- 3           1. Sample form letter for equipment field certification.
- 4           2. Certification that equipment has been installed properly, has been initially started up, has
- 5           been calibrated and/or adjusted as required, and is ready for operation.
- 6           3. Certification for major equipment supports that equipment foundation design loads shown
- 7           on the Drawings or specified have been compared to actual loads exhibited by equipment
- 8           provided for this Project and that said design loadings are equal to or greater than the loads
- 9           produced by the equipment provided.
- 10          4. Field noise testing reports if such testing is specified in narrow-scope Specification
- 11          Sections.
- 12          5. Certification from equipment manufacturer that all manufacturer-supplied control panels
- 13          that interface in any way with other controls or panels have been submitted to and
- 14          coordinated with the supplier/installer of those interfacing systems.
- 15          6. Motor test reports.
- 16          7. Certification prior to Project closeout that electrical panel drawings for manufacturer-
- 17          supplied control panels truly represent panel wiring including any field-made modifications.

## 18       **PART 2 - PRODUCTS**

### 19       **2.1    ACCEPTABLE MANUFACTURERS**

- 20       A. Subject to compliance with the Contract Documents, the following manufacturers are
- 21       acceptable:
- 22           1. Motors:
- 23               a. Baldor.
- 24               b. General Electric.
- 25               c. Marathon Electric.
- 26               d. Reliance Electric.
- 27               e. Siemens.
- 28               f. Teco-Westinghouse.
- 29               g. U.S. Motors.
- 30               h. WEG.
- 31       B. Submit request for substitution in accordance with Specification Section 01 25 13.

### 32       **2.2    MANUFACTURED UNITS**

- 33       A. Electric Motors:
- 34           1. Design for frequent starting duty equivalent to duty service required by driven equipment.
- 35           2. Design for full voltage starting.
- 36           3. Design bearing life based upon actual operating load conditions imposed by driven
- 37           equipment.
- 38           4. Design bearing life based upon actual operating load conditions imposed by driven
- 39           equipment.
- 40           5. Size for altitude of Project.
- 41           6. Furnish with stainless steel nameplates which include all data required by NEC Article 430.
- 42           7. Use of manufacturer's standard motor will be permitted on integrally constructed motor
- 43           driven equipment specified by model number in which a redesign of the complete unit
- 44           would be required in order to provide a motor with features specified.
- 45           8. AC electric motors greater than 10 HP:
- 46               a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
- 47               b. Oil or grease lubricated antifriction bearings conforming to ABMA standards.
- 48                   1) Design bearing life for 90 percent survival rating at 50,000 HRS of operation for
- 49                   motors up to and including 100 HP.

- 2) For motors greater than 100 HP, design bearing life for 90 percent survival rating at 100,000 HRS of operation.
  - c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
  - d. Thermal protection:
    - 1) Unless otherwise specified or indicated on the Drawings, motors 50 HP and above controlled from a variable frequency drive and for all other motors 100 HP and above, provide integral thermal detectors with normally closed contacts that will open on overtemperature.
      - a) Two (2) thermal sensing devices per phase in each phase hot-spot location.
  - e. Motors having a locked rotor inrush KVA greater than 6.3 times motor horsepower are not acceptable.
9. Motor enclosures:
- a. Totally enclosed (TEFC or TENV) motors shall be furnished on:
    - 1) Outdoor equipment.
    - 2) Equipment for installation below grade.
    - 3) Equipment operating in wet or dust-laden locations.
- B. NEMA Design Squirrel Cage Induction Motors 600V or less:
1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
  2. Furnish motors marketed and labeled as "NEMA Premium" energy efficient type, with efficiencies not less than the levels given in Table 12-12 of NEMA MG-1998, Rev. 2. Motor efficiencies shall be measure in accordance with NEMA MG-1.
  3. Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 40 DegC ambient.
  4. Design motors for continuous duty.
  5. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 percent greater than the maximum HP requirements of the driven equipment over its entire operating range.
    - a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.
  6. Provide conduit box one size larger than manufacturer's standard, complete with clamp type grounding terminals inside the conduit box. Conduit box shall be suitable for number and size of conduits indicated on the Drawings.
- C. Submersible Motors: Refer to individual narrow-scope Specification Sections for submersible motor requirements.
- D. V-Belt Drive:
1. Provide each V-belt drive with sliding base or other suitable tension adjustment.
  2. Provide V-belt drives with a service factor of at least 1.6 at maximum speed.
  3. Provide static-proof belts.

## 2.3 COMPONENTS

- A. Gear Drives and Drive Components:
1. Size drive equipment capable of supporting full load including losses in speed reducers and power transmission.
  2. Provide nominal input horsepower rating of each gear or speed reducer at least equal to nameplate horsepower of drive motor.
  3. Design drive units for 24 HR continuous service, constructed so oil leakage around shafts is precluded.
  4. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and flexible couplings meeting applicable standards of AGMA.
  5. Gear reducers:
    - a. Provide gear reducer totally enclosed and oil lubricated.

- b. Utilize antifriction bearings throughout.
- c. Provide worm gear reducers having a service factor of at least 1.20.
- d. Furnish other helical, spiral bevel, and combination bevel-helical gear reducers with a service factor of at least 1.50.

## 2.4 ACCESSORIES

### A. Guards:

- 1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
- 2. Interior applications:
  - a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
  - b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
  - c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
- 3. Exterior applications:
  - a. Construct from 16 GA stainless steel or aluminum.
  - b. Construct to preclude entrance of rain, snow, or moisture.
  - c. Roll to conform to shaft or coupling surface.
  - d. Connect to equipment frame with stainless steel bolts and wing nuts.

### B. Anchorage:

- 1. Cast-in-place anchorage:
  - a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
  - b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
  - c. Provide two (2) nuts for each bolt.
- 2. Drilled anchorage:
  - a. Adhesive anchors per Specification Section 05 50 00.
  - b. Epoxy grout per Specification Section 03 09 00.
  - c. Threaded rods same as cast-in-place.

### C. Data Plate:

- 1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
- 2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

### D. Gages:

- 1. Provide gages in accordance with Specification Section 40 91 10.
- 2. Provide at the following locations:
  - a. Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical and process equipment.
  - b. At locations identified on Drawings.
- 3. Utilize tapping sleeves for mounting per Specification Section 40 05 13.

### E. Lifting Eye Bolts or Lugs:

- 1. Provide on all equipment 50 LBS or greater.
- 2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.

### F. Platforms and Ladders:

- 1. Design and fabricate in accordance with OSHA Standards.
- 2. Fabricate components from aluminum.
- 3. Provide platform surface: Non-skid grating and/or checkered plate, unless specified in narrow-scope Specification Sections.

## 2.5 FABRICATION

- A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

- B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.
- C. Furnish like parts of duplicate units to be interchangeable.
- D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.
- E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
  - 1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.
- F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
  - 1. Provide drain connection for 3/4 IN PVC tubing.
- G. Machine the mounting feet of rotating equipment.
- H. Critical Speed:
  - 1. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
  - 2. Excessive vibration is sufficient cause for equipment rejection.
  - 3. Ratio of all rotative speeds to critical speed of a unit or components: Greater than 1.2.
- I. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
  - 1. Manufacturer's standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
  - 2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer's standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
  - 3. Affix entire assembly with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to delivery.
    - a. Control panels without an affixed UL 508A label shall be rejected.

## **2.6 SHOP OR FACTORY PAINT FINISHES**

- A. Electrical Equipment:
  - 1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Specification Section 09 91 00 to receive field painting.
    - a. Field painted equipment: See Specification Section 09 91 00 for factory applied primer/field paint compatibility requirements.
- B. Field paint other equipment in accordance with Specification Section 09 91 00.
  - 1. See Specification Section 09 91 00 for factory applied primer/field paint compatibility requirements.

## **2.7 SOURCE QUALITY CONTROL**

- A. Motor Tests:
  - 1. Test motors in accordance with NEMA and IEEE standards.
  - 2. Provide routine test for all motors.
  - 3. The Owner reserves the right to select and have tested, either routine or complete, any motor included in the project.
    - a. The Owner will pay all costs, including shipping and handling, for all motors successfully passing the tests.
    - b. The Contractor shall pay all costs, including shipping and handling, for all motors failing the tests.
    - c. If two (2) successive motors of the same manufacturer fail testing, the Owner has the right to reject all motors from that manufacturer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.
- B. Utilize templates for anchorage placement for slab-mounted equipment.
- C. For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.
  - 1. Route clear of major traffic areas and as approved by Engineer.
- D. DO NOT construct foundations until major equipment supports are approved.
- E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.
- F. Equipment Base:
  - 1. Construct level in both directions.
  - 2. Take particular care at anchor bolt locations so these areas are flat and level.
- G. Machine Base:
  - 1. Mount machine base of rotating equipment on equipment base.
    - a. Level in both directions, using a machinist level, according to machined surfaces on base.
  - 2. Level machine base on equipment base and align couplings between driver and driven unit using steel blocks and shims.
    - a. Size blocks and shims to provide solid support at each mounting bolt location.
      - 1) Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
    - b. Provide blocks and shims at each mounting bolt.
      - 1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
    - c. After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.
    - d. Do not use nuts below the machine base on anchor bolts for base leveling.
- H. Couplings:
  - 1. Align in the annular and parallel positions.
    - a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller.
      - 1) Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling 0.004 IN tolerance.
    - b. For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.
  - 2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
  - 3. Check surfaces for runout before attempting to trim or align units.
- I. Grouting:
  - 1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.
    - a. Extend dam or formwork to cover leveling shims and blocks.
    - b. Do not use nuts below the machine base to level the unit.
  - 2. Saturate top of roughened concrete subbase with water before grouting.
    - a. Add grout until entire space under machine base is filled to the top of the base underside.

- b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
  - a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
  - b. When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
  - c. Recheck driver-driven unit for proper alignment.

### **3.2 INSTALLATION CHECKS**

- A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
  1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
- B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
  1. Has been properly installed and lubricated.
  2. Is in accurate alignment.
  3. Is free from any undue stress imposed by connecting piping or anchor bolts.
  4. Has been operated under full load conditions and that it operated satisfactorily.
  - a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.
- C. No separate payment shall be made for installation checks.
  1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

### **3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS**

- A. Identify equipment and install hazard warning signs in accordance with Specification Section 10 14 00.

### **3.4 FIELD PAINTING AND PROTECTIVE COATINGS**

- A. For required field painting and protective coatings, comply with Specification Section 09 91 00.

### **3.5 WIRING CONNECTIONS AND TERMINATION**

- A. Clean wires before installing lugs and connectors.
- B. Terminate motor circuit conductors with copper lugs bolted to motor leads.
- C. Tape stripped ends of conductors and associated connectors with electrical tape.
  1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.
- D. Connections to carry full ampacity of conductors without temperature rise.
- E. Terminate spare conductors with electrical tape.

### **3.6 FIELD QUALITY CONTROL**

- A. Furnish equipment manufacturer services as specified in the individual equipment Specifications.
- B. Inspect wire and connections for physical damage and proper connection.
- C. Bump motor to check for correct rotation:
  1. Ensure motor has been lubricated.
  2. Check prior to connection to driven equipment.

- 1 D. Subbase that supports the equipment base and that is made in the form of a cast iron or steel  
2 structure that has supporting beams, legs and cross member that are cast welded or bolted, shall  
3 be tested for a natural frequency of vibration after equipment is mounted.  
4 1. Keep the ratio of the natural frequency of the structure to the frequency of the disturbing  
5 force out of the range from 0.5 to 1.5.

6 **3.7 DEMONSTRATION**

- 7 A. Demonstrate equipment in accordance with Specification Section 01 75 00.

8 **END OF SECTION**

**SECTION 40 05 13**  
**PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Process piping systems.
  2. Utility piping systems.
  3. Plumbing piping systems.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
  3. Section 31 21 33 - Trenching, Backfilling, and Compacting for Utilities.
  4. Section 09 91 00 - Painting and Protective Coatings.
  5. Section 10 14 00 - Identification Devices.
  6. Section 40 05 05 - Equipment: Basic Requirements.
  7. Section 40 91 10 - Primary Elements and Transmitters.
  8. Section 40 05 23 - Valves: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. American Association of State Highway and Transportation Officials (AASHTO):
    - a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).
    - b. M190, Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
    - c. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.
    - d. M294, Interim Specification for Corrugated Polyethylene Pipe 12 to 24 Inch Diameter.
  2. American Iron and Steel Institute (AISI).
  3. American Society of Mechanical Engineers (ASME):
    - a. B16.3, Malleable Iron Threaded Fittings.
    - b. B16.5, Pipe Flanges and Flanged Fittings.
    - c. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
    - d. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
    - e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
    - f. B36.19, Stainless Steel Pipe.
    - g. B40.100, Pressure Gauges and Gauge Attachments.
  4. ASTM International (ASTM):
    - a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
    - b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
    - c. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
    - d. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
    - e. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
    - f. A197, Standard Specification for Cupola Malleable Iron.
    - g. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
    - h. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

- i. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - j. A518, Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.
  - k. A536, Standard Specification for Ductile Iron Castings.
  - l. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
  - m. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
  - n. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
  - o. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
  - p. B88, Standard Specification for Seamless Copper Water Tube.
  - q. C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
  - r. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
  - s. C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
  - t. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
  - u. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
  - v. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
  - w. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
  - x. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
  - y. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
  - z. D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.
  - aa. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
  - bb. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
  - cc. {F491, Standard Specification for Poly(Vinylidene Fluoride)(PVDF) Plastic-Lined Ferrous Metal Pipe and Fittings.}
5. American Water Works Association (AWWA):
    - a. B300, Standard for Hypochlorites.
    - b. C200, Standard for Steel Water Pipe - 6 IN and Larger.
    - c. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
    - d. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
    - e. C606, Standard for Grooved and Shouldered Joints.
    - f. C651, Standard for Disinfecting Water Mains.
    - g. C800, Standard for Underground Service Line Valves and Fittings.
  6. American Water Works Association/American National Standards Institute (AWWA/ANSI):
    - a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
    - b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
    - c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
    - d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
    - e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
  7. Chlorine Institute, Inc. (CI):

- a. Pamphlet 6, Piping Systems for Dry Chlorine.
8. Cast Iron Soil Pipe Institute (CISPI):
  - a. 301, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
9. International Plumbing Code (IPC).
10. National Fire Protection Association (NFPA):
  - a. 54, National Fuel Gas Code.
  - b. 69, Standard on Explosion Prevention Systems.
11. Underwriters Laboratories, Inc. (UL).
- B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

### 1.3 DEFINITIONS

- A. Hazardous Gas Systems: Digester gas, chlorine gas, sulfur dioxide gas, carbon dioxide gas, lab gases.
- B. PVDF: Polyvinylidene fluoride.

### 1.4 SYSTEM DESCRIPTION

- A. Piping Systems Organization and Definition:
  1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
  2. See PIPING SPECIFICATION SCHEDULES in PART 3.

### 1.5 SUBMITTALS

- A. Shop Drawings:
  1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
    - c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
      - 1) Attach technical product data on gaskets, pipe, fittings, and other components.
  3. Fabrication and/or layout drawings:
    - a. Exterior yard piping drawings (minimum scale 1 IN equals 10 FT) with information including:
      - 1) Dimensions of piping lengths.
      - 2) Invert or centerline elevations of piping crossings.
      - 3) Acknowledgement of bury depth requirements.
      - 4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
      - 5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
      - 6) Line slopes and vents.
    - b. Interior piping drawings (minimum scale 1/8 IN equals 1 FT) with information including:
      - 1) Dimensions of piping from column lines or wall surfaces.
      - 2) Centerline dimensions of piping.
      - 3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
      - 4) Location and type of pipe supports and anchors.
      - 5) Locations of valves and valve actuator type.
      - 6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.

- 1 7) Acknowledgement of valve, equipment and instrument tag numbers.
- 2 8) Provisions for expansion and contraction.
- 3 9) Line slopes and air release vents.
- 4 10) Rough-in data for plumbing fixtures.
- 5 c. Schedule of interconnections to existing piping and method of connection.
- 6 B. Operation and Maintenance Manuals:
- 7 1. See Specification Section 01 33 04 for requirements for:
- 8 a. The mechanics and administration of the submittal process.
- 9 b. The content of Operation and Maintenance Manuals.
- 10 C. Informational Submittals:
- 11 1. Qualifications of lab performing disinfection analysis on water systems.
- 12 2. Test reports:
- 13 a. Copies of pressure test results on all piping systems.
- 14 b. Reports defining results of dielectric testing and corrective action taken.
- 15 c. Disinfection test report.
- 16 d. Notification of time and date of piping pressure tests.
- 17 **1.6 DELIVERY, STORAGE, AND HANDLING**
- 18 A. Protect pipe coating during handling using methods recommended by manufacturer.
- 19 1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is
- 20 not permitted.
- 21 B. Prevent damage to pipe during transit.
- 22 1. Repair abrasions, scars, and blemishes.
- 23 2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

## 24 **PART 2 - PRODUCTS**

### 25 **2.1 ACCEPTABLE MANUFACTURERS**

- 26 A. Subject to compliance with the Contract Documents, the following manufacturers are
- 27 acceptable:
- 28 1. Insulating unions:
- 29 a. "Dielectric" by Epco.
- 30 2. Dirt strainers (Y type):
- 31 a. Mueller (#351).
- 32 b. Sarco.
- 33 c. Armstrong.
- 34 3. Chemical strainers (Y type):
- 35 a. Chemtrol.
- 36 b. Asahi.
- 37 4. Dry disconnect couplings:
- 38 a. Kamlock.
- 39 5. Dielectric flange kit:
- 40 a. PSI.
- 41 b. Maloney.
- 42 c. Central Plastics.
- 43 6. Pipe saddles (for gage installation):
- 44 a. Dresser Style 91 (steel and ductile iron systems).
- 45 b. Dresser Style 194 (nonmetallic systems).
- 46 7. Expansion joint at FRP and poly tanks:
- 47 a. PROCO.
- 48 B. Submit request for substitution in accordance with Specification Section 01 25 13.

## 2.2 PIPING SPECIFICATION SCHEDULES

- A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Specification Section.

## 2.3 COMPONENTS AND ACCESSORIES

### A. Insulating Components:

1. Dielectric flange kits:
  - a. Flat faced.
  - b. 1/8 IN thick dielectric gasket, phenolic, non-asbestos.
  - c. Suitable for 175 psi, 210 DegF.
  - d. 1/32 IN wall thickness bolt sleeves.
  - e. 1/8 IN thick phenolic insulating washers.
2. Dielectric unions:
  - a. Screwed end connections.
  - b. Rated at 175 psi, 210 DegF.
  - c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.

### B. Dirt Strainers:

1. Y-type.
2. Composition bronze.
3. Rated for test pressure and temperature of system in which they are installed.
4. 20 mesh Monel screen.
5. Threaded bronze plug in the blowoff outlet.
6. Threaded NPT end connections.

### C. Strainers for Chemical Applications:

1. Y-type.
2. Strainers of same material, test pressure, and temperature rating as system in which strainer is placed.

### D. Reducers:

1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

### E. Protective Coating and Lining:

1. Include pipe, fittings, and appurtenances where coatings, linings, paint, tests and other items are specified.
2. Field paint pipe in accordance with Specification Section 09 91 00.

### F. Underground Warning Tape:

1. See Specification Section 10 14 00.

### G. Pressure Gages:

1. See Specification Section 40 05 05 and Specification Section 40 91 10.

### H. Dry Disconnect Couplings:

1. Adapters:
  - a. Male adapters: Size shown on Drawings.
  - b. Adapters:
    - 1) Female NPT end connection for sludge and flush applications.
    - 2) Male NPT end connection for chemical applications.
  - c. Construct adapters for sludge applications from cast iron or steel.
  - d. Construct adapters for chemical and PVC system applications 3 IN and below from polypropylene.
    - 1) Above 3 IN size, provide stainless steel units.
2. Couplers:

- a. Built-in valve and spring loaded poppet which close automatically when disconnected.
- b. Designed to remain with only one (1) arm locked in closed position.
- c. Construct couplers for sludge applications fabricated from material utilized for adapters.
- d. Construct couplers for chemical and PVC system applications 3 IN and less from polypropylene with stainless steel arms and pins.
  - 1) Above 3 IN, provide stainless steel units.
- e. Gasket: Compatible with conveyed liquid.
3. Dust caps: For all adapters.
- I. Sacrificial Anode Cathodic Protection:
  1. 3 LB magnesium sacrificial anodes, prepackaged in a cloth bag containing 75 percent hydrated gypsum, 20 percent bentonite and 5 percent anhydrous sodium sulphate.
  2. TW 600 V or an HMWPE insulated copper lead attached to the anode.
- J. Valves:
  1. See schematics and details for definition of manual valves used in each system under 4 IN in size.
    - a. See Specification Section 40 05 23 schedule for valve types 4 IN and above and for automatic valves used in each system.
  2. See Specification Section 40 05 23.
- K. Expansion Joints at FRP and Poly Tanks:
  1. Materials:
    - a. Bellows: PTFE-62.
    - b. Flanges: PVC, ductile iron.
    - c. Limit bolts and nuts: 316 stainless steel.
    - d. Reinforcing rings: Stainless steel.
  2. Pressure rating at 70 DegF: 70 psig.
  3. Minimum axial movement: 3/8 IN.

## **PART 3 - EXECUTION**

### **3.1 EXTERIOR BURIED PIPING INSTALLATION**

- A. Unless otherwise shown on the Drawings, provide a minimum of 3 FT and maximum of 6 FT earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.
- B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals specified in Specification Section 01 73 20 and as shown on Drawings.
- C. When entering or leaving structures with buried mechanical joint piping, install joint within 2 FT of point where pipe enters or leaves structure.
  1. Install second joint not more than 6 FT nor less than 4 FT from first joint.
- D. Install expansion devices as necessary to allow expansion and contraction movement.
- E. Laying Pipe In Trench:
  1. Excavate and backfill trench in accordance with Specification Section 31 21 33.
  2. Clean each pipe length thoroughly and inspect for compliance to specifications.
  3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
  4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
  5. Except for first two (2) joints, before making final connections of joints, install two (2) full sections of pipe with earth tamped along side of pipe or final with bedding material placed.
  6. Lay pipe in only suitable weather with good trench conditions.
    - a. Never lay pipe in water except where approved by Engineer.
  7. Seal open end of line with watertight plug if pipe laying stopped.

8. Remove water in trench before removal of plug.
- F. Lining Up Push-On Joint Piping:
  1. Lay piping on route lines shown on Drawings.
  2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
  3. Observe maximum deflection values stated in manufacturer's written literature.
  4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
  5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.
- G. Anchorage and Blocking:
  1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
  2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
    - a. Concrete blocks shall not cover pipe joints.
  3. Provide bearing area of concrete in accordance with drawing detail.
- H. Install underground hazard warning tape per Specification Section 10 14 00.
- I. Install insulating components where dissimilar metals are joined together.

### **3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION**

- A. Install piping in vertical and horizontal alignment as shown on Drawings.
- B. Alignment of piping smaller than 4 IN may not be shown; however, install according to Drawing intent and with clearance and allowance for:
  1. Expansion and contraction.
  2. Operation and access to equipment, doors, windows, hoists, moving equipment.
  3. Headroom and walking space for working areas and aisles.
  4. System drainage and air removal.
- C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified in Specification Section 01 73 20 and as shown on the Drawings.
- D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.
- E. Pipe Support:
  1. Use methods of piping support as shown on Drawings and as required in Specification Section 40 05 16.
  2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
    - a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
  3. Size pipe supports with consideration to specific gravity of liquid being piped.
- F. Locate and size sleeves and castings required for piping system.
  1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.
- G. Use reducing fittings throughout piping systems.
  1. Bushings will not be allowed unless specifically approved.
- H. Equipment Drainage and Miscellaneous Piping:
  1. Provide drip pans and piping at equipment where condensation may occur.
  2. Hard pipe stuffing box leakage to nearest floor drain.
  3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
    - a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
    - b. Hard pipe drainage to nearest floor drain.

- 1 4. Collect system condensate at drip pockets, traps and blowoff valves.
- 2 5. Provide drainage for process piping at locations shown on Drawings in accordance with
- 3 Drawing details.
- 4 6. For applications defined above and for other miscellaneous piping which is not addressed by
- 5 a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
- 6 a. Size to handle application with 3/4 IN being minimum size provided.
- 7 I. Unions:
- 8 1. Install in position which will permit valve or equipment to be removed without dismantling
- 9 adjacent piping.
- 10 2. Mechanical type couplings may serve as unions.
- 11 3. Additional flange unions are not required at flanged connections.
- 12 J. Install expansion devices as necessary to allow expansion/contraction movement.
- 13 K. Provide full face gaskets on all systems.
- 14 L. Anchorage and Blocking:
- 15 1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to
- 16 prevent separation of joints and transmission of stress into equipment or structural
- 17 components not designed to resist those stresses.
- 18 M. Equipment Pipe Connections:
- 19 1. Equipment - General:
- 20 a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of
- 21 pipe or fitting which would prevent uniform gasket pressure at connection or would
- 22 cause unnecessary stresses to be transmitted to equipment flanges.
- 23 b. Where push-on joints are used in conjunction with flanged joints, final positioning of
- 24 push-on joints shall not be made until flange joints have been tightened without strain.
- 25 c. Tighten flange bolts at uniform rate which will result in uniform gasket compression
- 26 over entire area of joint.
- 27 1) Provide tightening torque in accordance with manufacturer's recommendations.
- 28 d. Support and match flange faces to uniform contact over their entire face area prior to
- 29 installation of any bolt between the piping flange and equipment connecting flange.
- 30 e. Permit piping connected to equipment to freely move in directions parallel to
- 31 longitudinal centerline when and while bolts in connection flange are tightened.
- 32 f. Align, level, and wedge equipment into place during fitting and alignment of
- 33 connecting piping.
- 34 g. Grout equipment into place prior to final bolting of piping but not before initial fitting
- 35 and alignment.
- 36 h. To provide maximum flexibility and ease of alignment, assemble connecting piping
- 37 with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
- 38 1) Test alignment by loosening flange bolts to see if there is any change in
- 39 relationship of piping flange with equipment connecting flange.
- 40 2) Realign as necessary, install flange bolts and make equipment connection.
- 41 i. Provide utility connections to equipment shown on Drawings, scheduled or specified.
- 42 2. Plumbing and HVAC equipment:
- 43 a. Make piping connections to plumbing and HVAC equipment, including but not limited
- 44 to installation of fittings, strainers, pressure reducing valves, flow control valves and
- 45 relief valves provided with or as integral part of equipment.
- 46 b. Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control
- 47 valves, pressure relief valves, and shock absorbers which are not specified to be
- 48 provided with or as integral part of equipment.
- 49 c. For each water supply piping connection to equipment, furnish and install union and
- 50 gate or angle valve.
- 51 1) Provide wheel handle stop valve at each laboratory sink water supply.
- 52 2) Minimum size: 1/2 IN.

- 1 d. Furnish and install "P" trap for each waste piping connection to equipment if waste is  
2 connected directly to building sewer system.  
3 1) Size trap as required by IPC.  
4 e. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P"  
5 traps, miscellaneous traps and miscellaneous brass through wall or floor and cap and  
6 protect until such time when later installation is performed.
- 7 N. Provide insulating components where dissimilar metals are joined together.
- 8 O. Instrument Connections:  
9 1. See drawing details.
- 10 **3.3 CONNECTIONS WITH EXISTING PIPING**
- 11 A. Where connection between new work and existing work is made, use suitable and proper fittings  
12 to suit conditions encountered.
- 13 B. Perform connections with existing piping at time and under conditions which will least interfere  
14 with service to customers affected by such operation.
- 15 C. Undertake connections in fashion which will disturb system as little as possible.
- 16 D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed  
17 without damage to adjacent property.
- 18 E. Where connections to existing systems necessitate employment of past installation methods not  
19 currently part of trade practice, utilize necessary special piping components.
- 20 F. Where connection involves potable water systems, provide disinfection methods as prescribed in  
21 this Specification Section.
- 22 G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made  
23 and tested.
- 24 **3.4 ACCESS PROVISIONS**
- 25 A. Provide access doors or panels in walls, floors, and ceilings to permit access to valves, piping  
26 and piping appurtenances requiring service.
- 27 B. Size of access panels to allow inspection and removal of items served, minimum 10 x 14 IN size.
- 28 C. Fabricate door and frame of minimum 14 GA, stretcher leveled stock, cadmium plated or  
29 galvanized after fabrication and fitted with screw driver lock of cam type.
- 30 D. Provide with key locks, keyed alike, in public use areas.
- 31 E. Furnish panels with prime coat of paint.
- 32 F. Style and type as required for material in which door installed.
- 33 G. Where door is installed in fire-rated construction, provide door bearing UL label required for  
34 condition.
- 35 **3.5 PRESSURE GAGES**
- 36 A. Provide at locations shown on the Drawings and specified.
- 37 B. See Specification Section 40 05 05.
- 38 **3.6 FIELD QUALITY CONTROL**
- 39 A. Pipe Testing - General:  
40 1. Test piping systems as follows:  
41 a. Test exposed, non-insulated piping systems upon completion of system.  
42 b. Test exposed, insulated piping systems upon completion of system but prior to  
43 application of insulation.

- c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.
  - d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.
  2. Utilize pressures, media and pressure test durations as specified in the PIPING SPECIFICATION SCHEDULES.
  3. Isolate equipment which may be damaged by the specified pressure test conditions.
  4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
    - a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
    - b. Notify the Engineer 24 HRS prior to each test.
  5. Completely assemble and test new piping systems prior to connection to existing pipe systems.
  6. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
  7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.
- B. Pressure Testing:
1. Testing medium: Unless otherwise specified in the PIPING SPECIFICATION SCHEDULES, utilize the following test media.
    - a. Process and plant air systems:

PIPE LINE SIZE	SPECIFIED TEST PRESSURE	TESTING MEDIUM
2 IN and smaller	75 psi or less	Air or water
2 IN and smaller	Greater than 75 psi	Water
Greater than 2 IN	3 psi or less	Air or water
Greater than 2 IN	Greater than 3 psi	Water

- b. Laboratory gases and natural gas systems: Cylinder nitrogen.
- c. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 48 IN	Gravity	25 psig or less	Air or water
Above 48 IN	Gravity	25 psig or less	Water
All sizes	Pumped	250 psig or less	Water

2. Allowable leakage rates:
  - a. Hazardous gas systems, all exposed piping systems, all pressure piping systems and all buried, insulated piping systems which are hydrostatically pressure tested shall have zero leakage at the specified test pressure throughout the duration of the test.
  - b. Hydrostatic exfiltration and infiltration for sanitary and stormwater sewers (groundwater level is below the top of pipe):
    - 1) Leakage rate: 200 GAL per inch diameter per mile of pipe per day at average head on test section of 3 FT.
    - 2) Average head is defined from groundwater elevation to average pipe crown.
    - 3) Acceptable test head leakage rate for heads greater than 3 FT: Acceptable leakage rate (gallons per inch diameter per mile per day) equals 115 by (actual test head to the 1/2 power).
  - c. Hydrostatic infiltration test for sanitary and stormwater sewers (groundwater level is above the top of pipe):
    - 1) Allowable leakage rate: 200 GAL per inch diameter per mile of pipe per day when depth of groundwater over top of pipe is 2 to 6 FT.

- 2) Leakage rate at heads greater than 6 FT: Allowable leakage rate (gallons per inch diameter per mile of pipe per day) equals 82 by (actual head to the 1/2 power).
- d. Large diameter (above 48 IN) gravity plant piping systems shall have a maximum exfiltration of 25 gpd per inch-mile.
- e. Non-hazardous gas and air systems which are tested with air shall have a maximum pressure drop of 5 percent of the specified test pressure throughout the duration of the test.
- f. For low pressure (less than 25 psig) air testing, the acceptable time for loss of 1 psig of air pressure shall be:

PIPE SIZE (IN DIA)	TIME, MINUTES/100 FT
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
42	7.3
48	7.6

3. Hydrostatic pressure testing methodology:
- a. General:
- 1) All joints, including welds, are to be left exposed for examination during the test.
  - 2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
  - 3) Provide temporary restraints for expansion joints for additional pressure load under test.
  - 4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
  - 5) Do not paint or insulate exposed piping until successful performance of pressure test.
- b. Soil, waste, drain and vent systems:
- 1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.
  - 2) Eliminate leaks before proceeding with work or concealing piping.
  - 3) Minimum test heights shall be 10 FT above highest stack inlet.
- c. Larger diameter (above 36 IN) gravity plant piping:
- 1) Plug downstream end of segment to be tested.
    - a) Provide bracing as required.
  - 2) Fill segment and upstream structure to normal operating level as per hydraulic profile.
  - 3) Allow 24 HRS for absorption losses.
    - a) Refill to original level.
  - 4) Provide reservoir to maintain constant head over duration of test.
  - 5) Record reservoir water volume at beginning and end of test.
4. Natural gas systems - testing methodology:
- a. Maintain specified test pressure until each joint has been thoroughly examined for leaks by means of soap suds and glycerine.

- 1 b. Wipe joints clean after test.
- 2 5. Air testing methodology:
- 3 a. General:
- 4 1) Assure air is ambient temperature.
- 5 b. Low pressure air testing:
- 6 1) Place plugs in line and inflate to 25 psig.
- 7 2) Check pneumatic plugs for proper sealing.
- 8 3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psig
- 9 greater than ground water that may be over the pipe.
- 10 a) Use test gage conforming to ASME B40.100 with 0 to 15 psi scale and
- 11 accuracy of 1 percent of full range.
- 12 4) Allow 2 minutes for air pressure to stabilize.
- 13 5) After stabilization period (3.5 psig minimum pressure in pipe) discontinue air
- 14 supply to line segment.
- 15 6) Record pressure at beginning and end of test.
- 16 C. Dielectric Testing Methods and Criteria:
- 17 1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous
- 18 elements of construction to assure discontinuity has been maintained.
- 19 2. Wherever electrical contact is demonstrated by such test, locate the point or points of
- 20 continuity and correct the condition.

### 21 3.7 CLEANING

- 22 A. Cleaning:
- 23 1. Clean interior of piping systems thoroughly before installing.
- 24 2. Maintain pipe in clean condition during installation.
- 25 3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly
- 26 dress and make joint.
- 27 4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other
- 28 foreign materials which may have entered the system.
- 29 5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under
- 30 these Specifications.
- 31 a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and
- 32 sludge which may have accumulated by operation of system, from testing, or from other
- 33 causes.
- 34 b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or
- 35 furnishings, due to failure to properly clean piping system, without cost to Owner.

### 36 3.8 LOCATION OF BURIED OBSTACLES

- 37 A. Furnish exact location and description of buried utilities encountered and thrust block placement.
- 38 B. Reference items to definitive reference point locations such as found property corners, entrances
- 39 to buildings, existing structure lines, fire hydrants and related fixed structures.
- 40 C. Include such information as location, elevation, coverage, supports and additional pertinent
- 41 information.
- 42 D. Incorporate information on "As-Recorded" Drawings.

### 43 3.9 SCHEDULES

Service	Symbol	System No.	Construction	Size (in)	Material
Effluent Reuse	EF	3	Buried and Exposed	8	DIP
Effluent Reuse	EF	5	Buried	8	PVC
Pump Station Inlet	Inlet	5	Buried	10	PVC

1 A. SPECIFICATION SCHEDULE - SYSTEM 3

2 1. General:

3 a. Piping symbol and service:

4 1) EF – Effluent Reuse

5 b. Test requirements:

6 1) Test medium: Water.

7 2) Pressure: 125 psig.

8 3) Duration: 6 HRS.

9 c. Gaskets:

10 1) Flanged, push-on and mechanical joints (ductile iron): Rubber,

11 AWWA/ANSI C111/A21.11.

12 2) Grooved coupling joints (ductile and steel): Rubber, AWWA C606.

13 3) Flanged joints (steel): AWWA C207.

14 2. System components:

15 a. Pipe size 3 IN through 36 IN:

16 1) Exposed service:

17 a) Material:

18 (1) Flanged: Ductile iron, Class 53.

19 b) Reference: AWWA/ANSI C115/A21.15.

20 c) Lining: Cement.

21 d) Coating: Paint.

22 e) Fittings: Either AWWA/ANSI C110/A21.10 ductile or gray iron.

23 f) Joints:

24 (1) Flanged mechanical coupling (AWWA C606) joints.

25 (2) Provide screwed-on flanges at equipment, valves and structure  
26 penetrations.

27 2) Buried service:

28 a) Materials: Ductile iron, Class 250.

29 b) Reference: AWWA/ANSI C151/A21.51.

30 c) Lining: Cement.

31 d) Coating: Bituminous.

32 e) Fittings:

33 (1) Either AWWA/ANSI C110/A21.10 ductile or gray iron.

34 (2) Optional: AWWA/ANSI C153/A21.53 ductile iron compact fittings for  
35 sizes 3 IN to 16 IN.

36 f) Joints: Push-on with mechanical (stuffing box type) joints at fittings and  
37 valves.

38 SPECIFICATION SCHEDULE - SYSTEM 5

39 3. General:

40 a. Piping symbol and service:

41 1) EF – Effluent Reuse

42 2) Inlet – Lift Station Inlet Piping

43 b. Test requirements:

44 1) Test medium: Water.

45 2) Pressure: 125 psig.

46 3) Duration: 6 HRS.

47 4. System components:

48 a. Pipe size 8 IN:

49 1) Buried service:

50 a) Materials: PVC, C900 DR 18.

51 b) Reference: ASTM F477.

52 c) Lining: None.

53 d) Coating: None.

54 e) Fittings: Either ANSI C110 ductile or gray iron. Optional ANSI C153 ductile  
55 iron compact fittings for sizes 3 to 16 IN.

- 1 f) Joints: Pipe supplier shall calculated length of pipe required to be restrained .
- 2 All fittings and push-on joints within the calculated distance from a fitting
- 3 shall be restrained with MEGA LUG type restraining glands.
- 4 g) Color: Purple Reclaimed Pipe with “Reclaimed Water Do Not Drink”
- 5 markings.
- 6

7 **END OF SECTION**

**SECTION 40 05 23**  
**VALVES: BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Valving, actuators, and valving appurtenances.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 09 91 00 - Painting and Protective Coatings.
  - 4. Section 40 05 05 - Equipment: Basic Requirements.
  - 5. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Society of Mechanical Engineers (ASME):
    - a. B1.20.1, Pipe Threads, General Purpose.
    - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
    - c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - 2. ASTM International (ASTM):
    - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
    - b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
    - c. D638, Standard Test Method for Tensile Properties of Plastics.
    - d. D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
    - e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
    - f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
  - 3. American Water Works Association (AWWA):
    - a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
    - b. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
    - c. C504, Standard for Rubber-Seated Butterfly Valves.
    - d. C507, Standard for Ball Valves, 6 IN through 48 IN (150 MM through 1200 MM).
    - e. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
    - f. C541, Standard for Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
    - g. C542, Standard for Electric Motor Actuators for Valves and Slide Gates.
    - h. C550, Standard for Protective Coatings for Valves and Hydrants.
    - i. C606, Standard for Grooved and Shouldered Joints.
  - 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
    - a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 5. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    - b. MG 1, Motors and Generators.

### 1.3 DEFINITIONS

- A. The following are definitions of abbreviations used in this Specification Section or one (1) of the individual valve sections:
1. CWP: Cold water working pressure.
  2. SWP: Steam working pressure.
  3. WOG: Water, oil, gas working pressure.
  4. WWP: Water working pressure.

### 1.4 SUBMITTALS

- A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's installation instructions.
    - c. Valve pressure and temperature rating.
    - d. Valve material of construction.
    - e. Special linings.
    - f. Valve dimensions and weight.
    - g. Valve flow coefficient.
    - h. Wiring and control diagrams for electric or cylinder actuators.
  3. Test reports.
- B. Operation and Maintenance Manuals:
1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.
- C. Informational Submittals:
1. Verification from valve actuator manufacturer that actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted, and that the valve actuator responds correctly to the valve position command.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

### 2.2 MATERIALS

- A. Refer to individual valve Specification Sections.

### 2.3 VALVE ACTUATORS

- A. Valve Actuators - General:
1. Provide actuators as shown on Drawings or specified.
  2. Counter clockwise opening as viewed from the top.
  3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
  4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
  5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
  6. Extension stem:

- 1 a. Install where shown or specified.
- 2 b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator
- 3 shaft.
- 4 c. Pin all stem connections.
- 5 d. Center in valve box or grating opening band with guide bushing.
- 6 B. Buried Valve Actuators:
- 7 1. Provide screw or slide type adjustable cast iron valve box, 5 IN minimum diameter, 3/16 IN
- 8 minimum thickness, and identifying cast iron cover rated for traffic load.
- 9 2. Box base to enclose buried valve gear box or bonnet.
- 10 3. Provide 2 IN standard actuator nuts complying with AWWA C500, Section 3.16.
- 11 4. Provide at least two (2) tee handle keys for actuator nuts, with 5 FT extension between key
- 12 and handle.
- 13 5. Extension stem:
- 14 a. Provide for buried valves greater than 4 FT below finish grade.
- 15 b. Extend to within 6 IN of finish grade.
- 16 6. Provide concrete pad encasement of valve box as shown for all buried valves unless shown
- 17 otherwise.
- 18 C. Plastic Valve Vault:
- 19 1. Provide in non-traffic areas only on valve applications 3-1/2 IN and less.
- 20 2. Nominal 7-1/2 IN DIA top section.
- 21 3. Design unit for screw type extension section having nominal 9 IN DIA bell.
- 22 4. Cast iron ring and lid.
- 23 5. Constructed of injection molded polyolefin compound with fibrous inorganic component
- 24 reinforcing and UV stabilization.
- 25 6. Armor Access Boxes.
- 26 D. Exposed Valve Manual Actuators:
- 27 1. Provide for all exposed valves not having electric or cylinder actuators.
- 28 2. Provide handwheels for gate and globe valves.
- 29 a. Size handwheels for valves in accordance with AWWA C500.
- 30 3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and
- 31 smaller.
- 32 a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock
- 33 positions between full open and full close.
- 34 b. Provide at least two (2) levers for each type and size of valve furnished.
- 35 4. Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and
- 36 larger.
- 37 5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
- 38 6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
- 39 7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
- 40 a. Cadmium-plated chain looped to within 3 FT of finish floor.
- 41 b. Equip chain wheels with chain guides to permit rapid operation with reasonable side
- 42 pull without "gagging" the wheel.
- 43 8. Provide cast iron floor stands where shown on Drawings.
- 44 a. Stands to be furnished by valve manufacturer with actuator.
- 45 b. Stands or actuator to include thrust bearings for valve operation and weight of
- 46 accessories.

## 47 2.4 FABRICATION

- 48 A. End Connections:
- 49 1. Provide the type of end connections for valves as required in the Piping Schedules presented
- 50 in Specification Section 40 05 13 or as shown on the Drawings.
- 51 2. Comply with the following standards:
- 52 a. Threaded: ASME B1.20.1.



**SECTION 40 20 16**  
**PIPE: DUCTILE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Ductile iron piping, fittings, and appurtenances.
- B. Related Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Society of Mechanical Engineers (ASME):
    - a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
    - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
  - 2. ASTM International (ASTM):
    - a. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
  - 3. American Water Works Association (AWWA):
    - a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
    - b. C606, Standard for Grooved and Shouldered Joints.
  - 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
    - a. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
    - b. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
    - c. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
    - d. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
    - e. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
    - f. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - 5. Society of Automotive Engineers (SAE):
    - a. AMS-QQ-P-416, Cadmium Plating - Electro-deposited.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. See Specification Section 40 05 13.
  - 3. Certification of factory hydrostatic testing.
  - 4. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Flanged adaptors:
  - a. Rockwell (Style 912 (cast)).
  - b. Dresser (Style 127 (cast)).
2. Compression sleeve coupling:
  - a. Rockwell (Style 431 (cast)).
  - b. Dresser tyle 153 (cast)).
3. Mechanical coupling:
  - a. Victaulic (Style 31).
  - b. Tyler.
4. Glass lining:
  - a. Ceramic Coating (Non-Stick Glass Lining).
  - b. Permutit (SG-14 Glass Lining).
5. Insulating couplings:
  - a. Rockwell (Style 416).
  - b. Dresser (Style 39).
6. Reducing couplings:
  - a. Rockwell (Style 415).
  - b. Dresser (Style 62).
7. Transition coupling:
  - a. Rockwell (Style 413).
  - b. Dresser (Style 62).
8. Polyethylene encasement tape:
  - a. Chase (Chasekote 750).
  - b. Kendall (Polyken 900).
  - c. 3 M (Scotchrap 50).
9. Restrained joints:
  - a. American (Lock Fast) - 12 IN and below.
  - b. U.S. Pipe (TR-Flex) - 4 IN to 54 IN.
  - c. American (Lock Fast) - Above 12 IN.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

### **2.2 MATERIALS**

A. Ductile Iron Pipe:

1. AWWA/ANSI C115/A21.15.
2. AWWA/ANSI C150/A21.50.
3. AWWA/ANSI C151/A21.51.

B. Fittings and Flanges:

1. AWWA/ANSI C110/A21.10.
2. AWWA/ANSI C115/A21.15.
3. Flanges drilled and faced per ASME B16.1 for both 125 and 250 psi applications.

C. Nuts and Bolts:

1. Buried: Cadmium-plated meeting SAE AMS-QQ-P-416, Type 1, Class 2 (Cor-Ten) for buried application.
2. Exposed: Mechanical galvanized ASTM B695, Class 40.
3. Heads and dimensions per ASME B1.1.
4. Threaded per ASME B1.1.
5. Project ends 1/4 to 1/2 IN beyond nuts.

- D. Gaskets: See individual piping system requirements in Section 40 05 13.
- E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.
- F. Polyethylene Encasement: See AWWA/ANSI C105/A21.5.
- G. See Piping Schedules in Section 40 05 13.

## 2.3 MANUFACTURED UNITS

- A. Couplings:
  - 1. Flanged adaptors:
    - a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
    - b. Provide units specified in Article 2.1.
    - c. Supply flanges meeting standards of adjoining flanges.
    - d. Rate entire assembly for test pressure specified on piping schedule for each respective application.
  - 2. Compression sleeve coupling:
    - a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
    - b. Provide units specified in Article 2.1.
    - c. Supply flanges meeting standards of adjoining flanges.
    - d. Entire assembly to be rated for test pressure specified on piping schedule for each respective application.
    - e. Provide field coating for buried couplings per AWWA C203.
  - 3. Mechanical couplings:
    - a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 40 05 13.
    - b. Utilize units defined in Article 2.1.

## 2.4 FABRICATION

- A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.
- B. Furnish cast parts with lacquer finish compatible with finish coat.
- C. Glass Lining:
  - 1. Minimum two-coat process.
    - a. Base coat heated to solidly fuse glass to pipe surface.
    - b. Subsequent coat(s) heated to form integral bond with preceding coat.
  - 2. Final finish parameters:
    - a. Thickness: 8-12 mils.
    - b. Hardness: Above 5 on MOHS scale.
    - c. Density: 2.5-3.0 grams per cubic centimeter.
    - d. Metal to lining bonding: Capable of withstanding strain of 0.0001 IN/IN without damage to lining.
  - 3. Complete compatibility between fittings and piping.

## 2.5 LININGS AND COATINGS

- A. Where specified in piping schedule, provide linings to a minimum thickness of 40 mils.
  - 1. Polyethylene, "Polybond" by American Pipe.
  - 2. Polyurethane, "Polythane" by U.S. Pipe.
  - 3. Ceramic epoxy, "Protecto 401" by U.S. Pipe.
  - 4. Calcium aluminate, "Sewper Coat" by Griffin Pipe.

## 2.6 SOURCE QUALITY CONTROL

### A. Factory Test:

1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Joining Method - Push-On Mechanical (Gland-Type) Joints:

1. Install in accordance with AWWA/ANSI C111/A21.11.
2. Assemble mechanical joints carefully according to manufacturer's recommendations.
3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
4. Do not overstress bolts.
5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.

#### B. Joining Method - Push-On Joints:

1. Install in accordance with AWWA/ANSI C151/A21.51.
2. Assemble push-on joints in accordance with manufacturer's directions.
3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
  - a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
4. Assure the gasket groove is thoroughly clean.
5. For cold weather installation, warm gasket prior to placement in bell.
6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.

#### C. Joining Method - Flanged Joints:

1. Install in accordance with AWWA/ANSI C115/A21.15.
2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.
3. Make flange faces flat and perpendicular to pipe centerline.
4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
5. Allow one (1) flange free movement in any direction while bolts are being tightened.
6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
7. Gradually tighten flange bolts uniformly to permit even gasket compression.

#### D. Joining Method - Mechanical Coupling Joint:

1. Arrange piping so that pipe ends are in full contact.
2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

#### E. Flange Adaptors 12 IN and Less:

1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
2. Drill holes not more than 1/8 IN larger than diameter of stud projection.

#### F. Cutting:

1. Do not damage interior lining material during cutting.
2. Use abrasive wheel cutters or saws.





## SECTION 40 20 23

### PIPE: PLASTIC

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A. Section Includes:

1. Plastic pipe.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 13 - Pipe and Pipe Fittings: Basic Requirements.

##### 1.2 QUALITY ASSURANCE

A. See Specification Section 40 05 13.

B. Referenced Standards:

1. ASTM International (ASTM):

- a. PVC (polyvinyl chloride) materials:

- 1) D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
    - 2) D1785, Standard Specification for Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.
    - 3) D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
    - 4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
    - 5) D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
    - 6) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
    - 7) F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
    - 8) F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
    - 9) F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
    - 10) F949, Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.

- b. Installation:

- 1) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

2. American Water Works Association (AWWA):

- a. PVC (polyvinyl chloride) materials:

- 1) C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN Through 12 IN, for Water Distribution.
    - 2) C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.

- b. Polyethylene (PE) materials:

- 1) C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 IN through 3 IN, for Water Service.

3. NSF International (NSF).

1     **1.3 SUBMITTALS**

- 2           A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the  
3           submittal process.  
4           B. See Specification Section 40 05 13.

5     **PART 2 - PRODUCTS**

6     **2.1 PRESSURE PIPING (UNDERGROUND)**

- 7           A. Materials: Furnish materials in full compliance with following requirements:  
8           1. 4-12 IN: AWWA C900 PVC with Pressure Class of 100 psi per Table 2, AWWA C900.  
9           2. Joints for polyethylene pipe shall be fusion type in accordance with AWWA C901.  
10          3. Joints for PVC pipe shall be the elastomeric-gasket type with a pressure rating not less than  
11          pipe pressure rating meeting performance requirements of ASTM D3139.  
12          B. Installation:  
13          1. Field threading of PVC pipe will not be permitted.  
14          2. Perform installation procedures, handling, thrust blocking, connections, and other  
15          appurtenant operations in full compliance to the manufacturer's printed recommendations  
16          and in full observance to plan details when more stringent.

17    **PART 3 - EXECUTION**

18    **3.1 IDENTIFICATION**

- 19          A. Identify each length of pipe clearly at intervals of 5 FT or less.  
20          1. Include manufacturer's name and trademark.  
21          2. Nominal size of pipe, appurtenant information regarding polymer cell classification and  
22          critical identifications regarding performance specifications and NSF approvals when  
23          applicable.

24    **3.2 PRESSURE PIPING (UNDERGROUND)**

- 25          A. Installation:  
26          1. Field threading of PVC pipe will not be permitted.  
27          2. Perform installation procedures, handling, thrust blocking, connections, and other  
28          appurtenant operations in full compliance to the manufacturer's printed recommendations  
29          and in full observance to plan details when more stringent.

30                           **END OF SECTION**

1 **SECTION 40 50 10**  
2 **PLUG VALVES**

3 **PART 1 - GENERAL**

4 **1.1 SUMMARY**

- 5 A. Section Includes:  
6 1. Plug valves.  
7 B. Related Specification Sections include but are not necessarily limited to:  
8 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.  
9 2. Division 01 - General Requirements.  
10 3. Section 40 05 23 - Valves: Basic Requirements.

11 **1.2 QUALITY ASSURANCE**

- 12 A. Referenced Standards:  
13 1. American Society of Mechanical Engineers (ASME):  
14 a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250.  
15 2. ASTM International (ASTM):  
16 a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe  
17 Fittings.  
18 b. A536, Standard Specification for Ductile Iron Castings.  
19 c. D2240, Standard Test Method for Rubber Property-Durometer Hardness.  
20 3. American Water Works Association (AWWA):  
21 a. C504, Standard for Rubber-Seated Butterfly Valves.

22 **1.3 SUBMITTALS**

- 23 A. Shop Drawings:  
24 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of  
25 the submittal process.  
26 2. See Specification Section 40 05 23.  
27 B. Operation and Maintenance Manuals:  
28 1. See Specification Section 01 33 04 for requirements for:  
29 a. The mechanics and administration of the submittal process.  
30 b. The content of Operation and Maintenance Manuals.  
31 2. See Specification Section 40 05 23.

32 **PART 2 - PRODUCTS**

33 **2.1 ACCEPTABLE MANUFACTURERS**

- 34 A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific  
35 valve types are acceptable.  
36 B. Submit request for substitution in accordance with Specification Section 01 25 13.

37 **2.2 NON-LUBRICATED ECCENTRIC PLUG VALVES (SEWAGE)**

- 38 A. Acceptable Manufacturers:  
39 1. DeZurik.  
40 2. Millikin.  
41 3. ValMatic.

- 1 4. Victaulic.
- 2 B. Materials:
- 3 1. Body: Cast-iron ASTM A126, Class B.
- 4 2. Plug: One-piece construction ductile iron, ASTM A536 65-45-12 or cast iron, ASTM A126
- 5 Class B.
- 6 3. Plug facing: Grease and/or petroleum-resistant resilient Neoprene or Buna-N compound, 70
- 7 Type A durometer hardness per ASTM D2240.
- 8 4. Shaft bearing bushings: Permanently lubricated TFE or Delrin sleeve type stainless steel or
- 9 bronze.
- 10 5. Valve seats: Welded-in overlay of 90 percent nickel, minimum Brinell hardness of 200,
- 11 (minimum 1/8 IN thick).
- 12 6. Stem seal: Nitrile butadiene packing or Buna-N dual U-cups or bronze cartridge double O-
- 13 rings with lower grit seal O-ring per AWWA C504, Section 3.7.

## 14 **2.3 ACCESSORIES**

- 15 A. Refer to Drawings and valve schedule for type of actuator.
- 16 1. Furnish actuator integral with valve.
- 17 B. Refer to Specification Section 40 05 23 for actuator requirements.

## 18 **2.4 DESIGN REQUIREMENTS**

- 19 A. Non-Lubricated Eccentric Plug Valves (Wastewater, Sludge):
- 20 1. Port area:
- 21 a. Valves 4 IN through 20 IN: Equal to or exceed 80 percent of full pipe area.
- 22 2. Valve body: Fitted with bolted bonnet.
- 23 3. End connections: See Specification Section 40 05 23.
- 24 4. Stem seal: Adjustable and replaceable without disassembling valve or bonnet.
- 25 5. Designed for seating drip tight in any flow direction.
- 26 6. Rating:
- 27 a. 1/2 through 12 IN, 175 psi working pressure.
- 28 7. Actuator:
- 29 a. Actuator gearing in enclosure suitable for running in oil with seals on shaft to prevent
- 30 entry of dirt or water.
- 31 b. Positive identification on actuator indicating valve position.
- 32 c. Adjustable stop to set closing torque.

## 33 **2.5 FABRICATION**

- 34 A. See Specification Section 40 05 23.

# 35 **PART 3 - EXECUTION**

## 36 **3.1 INSTALLATION**

- 37 A. See Specification Section 40 05 23.
- 38 B. Install valves with valve stem horizontal, plug seat on inlet side and with plug rotating up into
- 39 the open position for valves in horizontal lines.
- 40 C. Install valve with actuator above pipe or plug centerline.

41 **END OF SECTION**

**SECTION 40 90 00**  
**INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Basic requirements for complete instrumentation system for process control.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 10 14 00 - Identification Devices.
  - 4. Section 40 98 00 - Control Panels and Enclosures.
  - 5. Section 26 05 19 - Wire and Cable - 600 Volt and Below.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. Canadian Standards Association (CSA).
  - 2. FM Global (FM).
  - 3. The International Society of Automation (ISA):
    - a. S5.1, Instrumentation Symbols and Identification.
    - b. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
    - c. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
  - 4. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 5. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
  - 6. National Institute of Standards and Technology (NIST).
- B. Qualifications:
  - 1. Instrumentation subcontractor:
    - a. Experience:
      - 1) Have satisfactorily provided a control system for a minimum of five (5) projects of similar magnitude and function.
- C. Miscellaneous:
  - 1. Comply with electrical classifications and NEMA enclosure types shown on Drawings.

**1.3 DEFINITIONS**

- A. Outdoor Area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
- B. Calibrate: To standardize a device so that it provides a specified response to known inputs.

**1.4 SYSTEM DESCRIPTION**

- A. Control System Requirements:
  - 1. This Specification Section provides the general requirements for the instrument and control system.

2. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the plant as specified in the Contract Documents.
- B. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.
- C. Instrumentation Subcontractor:
  1. Ensure coordination of instrumentation with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

## 1.5 SUBMITTALS

- A. Shop Drawings:
  1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  2. Submittals shall be original printed material or clear unblemished photocopies of original printed material.
    - a. Facsimile information is not acceptable.
  3. Limit the scope of each submittal to one (1) Specification Section.
    - a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.
    - b. Do not provide any submittals for Specification Section 40 90 00.
  4. Product technical data including:
    - a. Equipment catalog cut sheets.
    - b. Instrument data sheets:
      - 1) ISA S20 or approved equal.
      - 2) Separate data sheet for each instrument.
    - c. Materials of construction.
    - d. Minimum and maximum flow ranges.
    - e. Pressure loss curves.
    - f. Physical limits of components including temperature and pressure limits.
    - g. Size and weight.
    - h. Electrical power requirements and wiring diagrams.
    - i. NEMA rating of housings.
    - j. Submittals shall be marked with arrows to show exact features to be provided.
  5. Comprehensive set of wiring diagrams as specified in Specification Section 40 98 00.
  6. Panel fabrication drawings as specified in Specification Section 40 98 00.
  7. PLC/DCS equipment drawings.
  8. HMI graphics.
  9. Nameplate layout drawings.
  10. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
    - a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
  11. All Shop Drawings shall be modified with as-built information/corrections.
  12. All panel and wiring drawings shall be provided in both hardcopy and softcopy.
    - a. Furnish electronic files on CD-ROM or DVD-ROM media.
    - b. Drawings in AUTO CAD format.
  13. Provide a parameter setting summary sheet for each field configurable device.
  14. Certifications:
    - a. Documentation verifying that calibration equipment is certified with NIST traceability.

- 1 b. Approvals from independent testing laboratories or approval agencies, such as UL, FM
- 2 or CSA.
- 3 1) Certification documentation is required for all equipment for which the
- 4 specifications require independent agency approval.
- 5 15. Testing reports: Source quality control reports.
- 6 B. Operation and Maintenance Manuals:
- 7 1. See Specification Section 01 33 04 for requirements for:
- 8 a. The mechanics and administration of the submittal process.
- 9 b. The content of Operation and Maintenance Manuals.
- 10 2. Warranties: Provide copies of warranties and list of factory authorized service agents.
- 11 **1.6 DELIVERY, STORAGE, AND HANDLING**
- 12 A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the
- 13 instrumentation during shipment until the instruments are installed and permanent connections
- 14 are made.
- 15 **1.7 SITE CONDITIONS**
- 16 A. Unless designated otherwise on the Drawings, area designations are as follows:
- 17 1. Outdoor area:
- 18 a. Wet.
- 19 b. Below grade vaults and manholes:
- 20 1) Subject to temporary submergence when specifically designated on the Drawings
- 21 or Specifications.

## 22 **PART 2 - PRODUCTS**

### 23 **2.1 NEMA TYPE REQUIREMENTS**

- 24 A. Provide enclosures/housing for control system components in accordance with the following:
- 25 1. Areas designated as wet: NEMA Type 4X.

### 26 **2.2 PERFORMANCE AND DESIGN REQUIREMENTS**

- 27 A. System Operating Criteria:
- 28 1. Stability: After controls have taken corrective action, as result of a change in the controlled
- 29 variable or a change in setpoint, oscillation of final control element shall not exceed two (2)
- 30 cycles per minute or a magnitude of movement of 0.5 percent full travel.
- 31 2. Response: Any change in setpoint or change in controlled variable shall produce a
- 32 corresponding corrective change in position of final control element and become stabilized
- 33 within 30 seconds.
- 34 3. Agreement: Setpoint indication of controlled variable and measured indication of controlled
- 35 variable shall agree within 3 percent of full scale over a 6:1 operating range.
- 36 4. Repeatability: For any repeated magnitude of control signal, from either an increasing or
- 37 decreasing direction, the final control element shall take a repeated position within 0.5
- 38 percent of full travel regardless of force required to position final element.
- 39 5. Sensitivity: Controls shall respond to setpoint deviations and measured variable deviations
- 40 within 1.0 percent of full scale.
- 41 6. Performance: All instruments and control devices shall perform in accordance with
- 42 manufacturer's specifications.

### 43 **2.3 ACCESSORIES**

- 44 A. Provide identification devices for instrumentation system components in accordance with
- 45 Specification Section 10 14 00.
- 46 B. Provide corrosion resistant spacers to maintain 1/4 IN separation between equipment and
- 47 mounting surface in wet areas, on below grade walls and on walls of liquid containment or
- 48 processing areas such as Clarifiers, Digesters, Reservoirs, etc.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.
- B. Install electrical components per Division 26.
- C. Panel-Mounted Instruments:
  - 1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
  - 2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.
- D. See Specification Section 26 05 19.

### **3.2 FIELD QUALITY CONTROL**

- A. See Specification Section 01 75 00.
- B. Maintain accurate daily log of all startup activities, calibration functions, and final setpoint adjustments.
  - 1. Documentation requirements include the utilization of the forms located at the end of this Specification Section.
    - a. Loop Check-out Sheet.
    - b. Instrument Certification Sheet.
    - c. Final Control Element Certification Sheet.
- C. Instrumentation Calibration:
  - 1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
  - 2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to assure proper installed operation.
  - 3. Calibrate in accordance with the manufacturer's specifications.
  - 4. Bench calibrate pressure and temperature gages.
    - a. Field mount gage within seven (7) days of calibration.
  - 5. Check the calibration of each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 percent.
    - a. Check for both increasing and decreasing input signals to detect hysteresis.
  - 6. Replace any instrument which cannot be properly adjusted.
  - 7. Calibration equipment shall be certified by an independent agency with traceability to NIST.
    - a. Certification shall be up-to-date.
    - b. Use of equipment with expired certifications shall not be permitted.
  - 8. Calibration equipment shall be at least three (3) times more accurate as the device being calibrated.
- D. Loop check-out requirements are as follows:
  - 1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections.
    - a. Use actual signals where available.
    - b. Closely observe controllers, indicators, transmitters, HMI displays, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components.
      - 1) Verify that readings at all loop components are in agreement.
      - 2) Make corrections as required.
        - a) Following any corrections, retest the loop as before.
  - 2. Check all interlocks to the maximum extent possible.
  - 3. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.
- E. Provide verification of system assembly, power, ground, and I/O tests.

1 F. Verify existence and measure adequacy of all grounds required for instrumentation and controls.

3 **END OF SECTION**



**SECTION 40 91 10**  
**PRIMARY METERS AND TRANSMITTERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Flow components.
  - 2. Level components.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Iron and Steel Institute (AISI).
  - 2. American National Standards Institute (ANSI).
  - 3. American Society of Mechanical Engineers (ASME):
    - a. B16.5, Pipe Flanges and Flanged Fittings.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. See Specification Section 40 90 00.
- B. Operation and Maintenance Manuals:
  - 1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Magnetic Flow Meters:
  - 1. Acceptable manufacturers:
    - a. ABB.
  - 2. Design and fabrication:
    - a. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
    - b. High input impedance pre-amplifiers.
      - 1) Minimum impedance:  $10^{10}$  ohms.
    - c. Provide flanged end connections per ASME B16.5 rated for piping system operating and test conditions.
    - d. Grounding requirements:
      - 1) Nonmetallic or lined pipe:
        - a) Inlet and outlet grounding rings of same material as electrode.
      - 2) Conductive piping:
        - a) Conductive path between the meter and the piping flanges.
    - e. Provide cable between magnetic flow meter and transmitter.

- f. Pulsed DC magnetic field excitation.
  - g. Automatic zero.
  - h. Adjustable low flow cutoff.
  - i. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
  - j. Inaccuracy:
    - 1) Above 10 percent of range:  $\pm 1.0$  percent of rate.
    - 2) Below 10 percent of range:  $\pm 0.1$  percent of range setting.
    - 3) Add  $+0.1$  percent of range to above inaccuracies for analog outputs.
  - k. 4-20 mA DC isolated output into maximum 800 ohms.
  - l. Power supply: 117 V  $\pm 10$  percent, 60 Hz.
  - m. Indication of flow rate and totalized flow at transmitter.
  - n. Meter operable as specified in liquids with 5.0 micro mho/cm or more conductivity.
  - o. Transmitter electronics shall use microprocessor based architecture and be configured using parameters.
  - p. Transmitter housing: NEMA 4X rated. Provide sunshield for housing.
3. Schedule:

TAG NUMBER	SERVICE	FLOW RANGE (GPM)	METER SIZE (IN)
FIT-1	Re-Use Force Main	0-2000	8

TAG NUMBER	LINER MATERIAL	ELECTRODE MATERIAL	INTEGRAL, FIELD OR PANEL-MOUNTED TRANSMITTER
FIT-1	Hard Rubber	Stainless Steel	Field

## 2.2 LEVEL ELEMENTS

- A. Ultrasonic Level Sensor and Transmitter:
1. Acceptable manufacturers:
    - a. Milltronics.
    - b. Endress and Hauser.
  2. Materials:
    - a. Sensor wetted parts: PVC, polypropylene, KYNAR or PVDF.
  3. Design and fabrication:
    - a. Sensor:
      - 1) Emits ultrasonic sound.
      - 2) Detects return echo reflected from surface and converts it to electrical energy proportional to level.
    - b. Temperature compensated.
    - c. Operating temperature: -4 to 140 DegF.
    - d. Humidity: 95 percent non-condensing.
    - e. Transmitter:
      - 1) Capable of producing output signal proportional to level of 4-20 mA DC into 500 ohm load.
      - 2) Power supply: 120 Vac ( $\pm 10$  percent), 60 Hz.
      - 3) Inaccuracy: 0.25 percent of range or 0.24 IN, whichever is greater.
      - 4) Resolution: 0.1 percent of span or 0.08 IN, whichever is greater.
      - 5) Display: Four-digit LED or LCD scalable to engineering units with selectable decimal point.
      - 6) Temperature: -5 to 122 DegF.
      - 7) Humidity: 95 percent noncondensing.

- 8) Memory: EEPROM (non-volatile).
- 9) Keypad programmer.
- 10) NEMA 4X enclosure.
4. Schedule:

TAG NUMBER	SERVICE	MAXIMUM DEPTH TO LIQUID SURFACE	MOUNT
LIT-1	Re-Use Storage Tank Level	25 FT	See Dwgs

### 2.3 ACCESSORIES

- A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
  1. Materials, unless otherwise specified, shall be as follows:
    - a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
- B. Provide handheld communicator compatible with all intelligent transmitters furnished.
  1. Hand held communicator shall provide capability to check calibration, change transmitter range, and provide diagnostics.
  2. If these features are provided with the intelligent transmitter, the hand held communicator is not required.
- C. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on Drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Instrument Mounting:
  1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
  2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
  3. Mount instruments level, plumb, and support rigidly.
  4. Mount to provide:
    - a. Protection from heat, shock, and vibrations.
    - b. Accessibility for maintenance.
    - c. Freedom from interference with piping, conduit and equipment.
  5. Instruments installed outdoors shall be provided with sunshields.

### 3.2 TRAINING

- A. Provide on-site training in accordance with Specification Section 01 75 00.

**END OF SECTION**



**SECTION 40 98 00**  
**CONTROL PANELS AND ENCLOSURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Requirements for control panels and enclosures utilized as follows:
    - a. Unless noted otherwise, all control panels and enclosures housing control components that are specified in Specification Section 40 91 10, Specification Section 27 21 00, or Specification Section 40 99 00.
- B. Related Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  2. Division 01 - General Requirements.
  3. Section 10 14 00 - Identification Devices.
  4. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.
  5. Section 40 91 10 - Primary Elements and Transmitters.
  6. Section 27 21 00 - Telemetry Systems.
  7. Section 40 99 00 - Surge Protection Devices (SPD) for Instrumentation and Control Equipment.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
1. American National Standards Institute (ANSI).
  2. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    - b. ICS 4, Industrial Control and Systems: Terminal Blocks.
  3. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC):
      - 1) Article 409, Industrial Control Panels.
  4. Underwriters Laboratories, Inc. (UL):
    - a. 508A, Standard for Safety Industrial Control Panels.
- B. Miscellaneous:
1. Approved supplier of Industrial Control Panels under provisions of UL 508A.
    - a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.
    - b. Control panel(s) without an affixed UL 508A label shall be rejected and sent back to the Contractor's factory.

**1.3 DEFINITIONS**

- A. The term "panel" refers to control panels or enclosures listed in the schedule included in this Specification Section.
- B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.
- C. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- D. Instrumentation Cable:
1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
  2. Instrumentation cable is typically either TSP (twisted-shielded pair) or TST (twisted-shielded triad), and is used for the transmission of low current or low voltage signals.

- E. Ground Fault Circuit Interrupter (GFCI): A type of device (e.g., circuit breaker or receptacle) which detects an abnormal current flow to ground and opens the circuit preventing a hazardous situation.
- F. Programmable Logic Controller (PLC): A specialized industrial computer using programmed, custom instructions to provide automated monitoring and control functions by interfacing software control strategies to input/output devices.
- G. Remote Terminal Unit (RTU): An industrial data collection device designed for location at a remote site, that communicates data to a host system by using telemetry such as radio, dial-up telephone, or leased lines.
- H. Input/Output (I/O): Hardware for the moving of control signals into and/or out of a PLC or RTU.
- I. Supervisory Control and Data Acquisition (SCADA): Used in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by computer workstations.
- J. Highway Addressable Remote Transducer (HART): An open, master-slave protocol for bus addressable field instruments.
- K. Digital Signal Cable: Used for the transmission of digital communication signals between computers, PLCs, RTUs, etc.
- L. Uninterruptible Power Supply (UPS): A backup power unit that provides continuous power when the normal power supply is interrupted.
- M. Loop Calibrator: Portable testing and measurement tool capable of accurately generating and measuring 4-20ma DC analog signals.

#### 1.4 SUBMITTALS

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. See Specification Section 40 90 00.
  - 3. Prepared with computer aided design (CAD) software.
  - 4. Printed on 11 by 17 IN sheets.
  - 5. Drawings shall include a title block containing the following:
    - a. Plant or facility name where panel(s) are to be installed.
    - b. Drawing title.
    - c. Drawing number.
    - d. Revision list with revision number and date
    - e. Drawing date.
    - f. Drawing scale.
    - g. Manufacturer name, address, and telephone number.
  - 6. Cover sheet for each drawing set shall indicate the following:
    - a. Plant or facility name.
    - b. Project name.
    - c. Submittal description.
    - d. Revision number.
    - e. Issue date.
  - 7. Table of contents sheet(s) shall indicate the following for each drawing in the set:
    - a. Drawing number.
    - b. Drawing title.
    - c. Sheet number.
  - 8. Legend and abbreviation sheet shall indicate the following:
    - a. Description of symbols and abbreviations used.
    - b. Panel construction notes including enclosure NEMA rating, finish type and color, wire type, wire color strategy, conductor sizes, and wire labeling strategy.

- 1 c. Confirmation that the panel(s) are to be affixed with a UL 508A label prior to shipment
- 2 from the factory.
- 3 9. Bill of Material for each panel shall include the following component information:
- 4 a. Instrument tag number.
- 5 b. Quantity.
- 6 c. Functional name or description.
- 7 d. Manufacturer.
- 8 e. Complete model number.
- 9 f. Size or rating.
- 10 10. Panel exterior layout drawings to scale and shall indicate the following:
- 11 a. Panel materials of construction, dimensions, and total assembled weight.
- 12 b. Panel access openings.
- 13 c. Conduit access locations.
- 14 d. Front panel device layout.
- 15 e. Nameplate schedule:
- 16 1) Nameplate location.
- 17 2) Legend which indicates text, letter height and color, and background color.
- 18 f. Alarm annunciator window engraving schedule.
- 19 g. Layouts of graphic panels or mosaic displays.
- 20 11. Panel interior layout drawings shall be drawn to scale and shall indicate the following:
- 21 a. Sub-panel or mounting pan dimensions.
- 22 b. Interior device layouts.
- 23 c. PLC/RTU general arrangement layouts.
- 24 d. Wire-way locations, purpose, and dimensions.
- 25 e. Terminal strip designations.
- 26 f. Location of external wiring and/or piping connections.
- 27 g. Location of lighting fixtures, switches and receptacles.
- 28 12. Wiring diagrams shall consist of the following:
- 29 a. Panel power distribution diagrams.
- 30 b. Control and instrumentation wiring diagrams.
- 31 c. PLC/RTU I/O information:
- 32 1) Model number of I/O module.
- 33 2) Description of I/O module type and function.
- 34 3) Rack and slot number.
- 35 4) Terminal number on module.
- 36 5) Point or channel number.
- 37 6) Programmed point addresses.
- 38 7) Signal function and type.
- 39 d. Wiring diagrams shall identify each wire as it is to be labeled.
- 40 B. Manufacturer catalog cut sheets for enclosure, finish, panel devices, control auxiliaries, and
- 41 accessories.
- 42 C. Electrical load calculations for each panel:
- 43 1. Total connected load.
- 44 2. Peak electrical demand for each panel.
- 45 D. Climate control calculations for each panel.
- 46 1. Verify that sufficient dissipation and/or generation of heat is provided to maintain interior
- 47 panel temperatures within the rated operating temperatures of panel components.
- 48 E. Operation and Maintenance Manuals:
- 49 1. See Specification Section 01 33 04 for requirements for:
- 50 a. The mechanics and administration of the submittal process.
- 51 b. The content of Operation and Maintenance Manuals.
- 52 2. See Specification Section 40 90 00.
- 53 F. Informational Submittals:

1. Record Drawings:
  - a. Updated panel drawings delivered with the panel(s) from the Contractor's factory.
  - b. Drawings shall be enclosed in transparent plastic and firmly secured within each panel.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  1. Enclosures:
    - a. Hoffman Engineering Co.
    - b. Rittal.
    - c. Hammond Manufacturing.
    - d. Millbank Mfg. Co.
  2. Panel heaters:
    - a. Hoffman Enclosures, Inc.
    - b. Rittal.
    - c. Hammond Manufacturing.
  3. Heat exchangers and air conditioners:
    - a. Hoffman Enclosures, Inc.
    - b. Rittal.
    - c. Hammond Manufacturing.
  4. Cooling fans and exhaust packages:
    - a. Hoffman Enclosures, Inc.
    - b. Rittal.
  5. Internal corrosion inhibitors:
    - a. Hoffman Enclosures, Inc.; Model A-HCI.
    - b. Northern Technologies International Corporation (NTIC); Model Zerust VC.
    - c. Cortec Corporation; Model VpCI Emitting Systems.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

### **2.2 ACCESSORIES**

- A. Panel Nameplates and Identification:
  1. See Section 10 14 00.

### **2.3 FABRICATION**

- A. General:
  1. Fabricate panels with instrument arrangements and dimensions identified in the Contract Documents.
  2. Provide panel(s) with the required enclosure rating per NEMA 250 to meet classifications identified in the Contract Documents.
  3. Devices installed in panel openings shall have a NEMA enclosure rating at least equal to the panel enclosure rating.
    - a. Devices that cannot be obtained with an adequate NEMA rating shall be installed behind a transparent viewing window.
    - b. The window shall maintain the required NEMA rating of the enclosure.
  4. Panel(s) shall be completely assembled at the Contractor's factory.
    - a. No fabrication other than correction of minor defects or minor transit damage shall be performed on panels at the jobsite.
  5. Painting:
    - a. Panels fabricated from steel shall have their internal and external surfaces prepared, cleaned, primed, and painted.
      - 1) Mechanically abrade all surfaces to remove rust, scale, and surface imperfections.

- 2) Provide final surface treatment with 120 grit abrasives or finer, followed by spot putty to fill all voids.
  - 3) Utilize solvent or chemical methods to clean panel surfaces.
  - 4) Apply surface conversion of zinc phosphate prior to painting to improve paint adhesion and to increase corrosion resistance.
  - 5) Electrostatically apply polyester urethane powder coating to all inside and outside surfaces.
  - 6) Bake powder coating at high temperatures to bond coating to enclosure surface.
    - a) Panel interior shall be white with semi-gloss finish.
    - b) Panel exterior shall be ANSI #61 gray with flat finish.
  - 7) Application of alkyd liquid enamel coating shall be allowed in lieu of polyester urethane powder for wall mounted NEMA 1 or NEMA 12 rated panels.
    - b. Panels fabricated from stainless steel, aluminum, or fiberglass shall not be painted.
  6. Finish opening edges of panel cutouts to smooth and true surface conditions.
    - a. Panels fabricated from steel shall have the opening edges finished with the panel exterior paint.
  7. Panel shall meet all requirements of UL 508A.
    - a. If more than one (1) disconnect switch is required to disconnect all power within a panel or enclosure, provide a cautionary marking with the word "CAUTION" and the following or equivalent, "Risk of Electric Shock-More than one (1) disconnect switch required to de-energize the equipment before servicing."
  8. Provide control panel in accordance with NFPA 70, Article 409.
    - a. In the event of any conflict between NFPA 70, Article 409 and UL 508A, the more stringent requirement shall apply.
- B. Free-Standing Panels:
1. Welded construction.
  2. Completely enclosed, self-supporting, and gasketed dusttight.
  3. Rolled lip around all sides of enclosure door opening.
  4. Seams and corners welded and ground smooth to touch and smooth in visual appearance.
  5. Full height, fully gasketed flush pan doors.
  6. Full length piano hinges rated for 1.5 times door plus instrument weight.
  7. Doors with keyed alike locking handles and three-point catch.
  8. Appropriate conduit, wiring, and instrument openings shall be provided.
  9. Lifting eyebolts to allow simple, safe rigging and lifting of panel during installation.
- C. Wall Mounted Panels:
1. Seams continuously welded and ground smooth.
  2. Rolled lip around all sides of enclosure door opening.
  3. Gasketed dust tight.
  4. Door clamps and hasp/staple for padlocking.
  5. Key doors alike.
  6. Continuous heavy GA hinge pin on doors.
    - a. Hinges rated for 1.5 times door plus instrument weight.
  7. Front full opening door.
  8. Brackets for wall mounting.
- D. Internal Panel Wiring:
1. Panel wire duct shall be installed between each row of components, and adjacent to each terminal strip.
    - a. Route wiring within the panel in wire-duct neatly tied and bundled with tie wraps.
    - b. Follow wire-duct manufacturer's recommended fill limits.
    - c. Wire-duct shall have removable snap-on covers and perforated walls for easy wire entrance.
    - d. Wire-duct shall be constructed of nonmetallic materials with rating in excess of the maximum voltage carried therein.

2. Wiring shall be installed such that if wires are removed from one (1) device, source of power will not be disrupted to other devices.
  3. Splicing and tapping of wires permitted only at terminal blocks.
  4. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire.
    - a. Protect bend area with sleeve.
  5. Arrange wiring neatly, cut to proper length, with surplus wire removed.
    - a. Arrange wiring with sufficient clearance.
    - b. Provide abrasion protection for wire bundles that pass through openings or across edges of sheet metal.
  6. AC circuits shall be routed separate from analog signal cables and digital signal cables.
    - a. Separate by at least 6 IN, except at unavoidable crossover points and at device terminations.
  7. Wiring to pilot devices or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without removing terminations.
  8. Conductors for AC and DC circuits shall be type MTW stranded copper listed for operation with 600 V at 90 DegC.
    - a. Conductor size shall be as required for load and 16 AWG minimum.
    - b. Internal panel wiring color code:
      - 1) AC circuits:
        - a) Power wiring: Black.
        - b) Control interconnections: Yellow.
        - c) Neutral: White.
        - d) Ground: Green.
      - 2) Low voltage DC circuits:
        - a) Power wiring: Blue.
        - b) Control interconnections: Violet.
      - 3) Foreign voltage circuits: Pink.
      - 4) Annunciator circuits: Red.
  9. Analog signal cables shall be of 600 V insulation, stranded copper, twisted-shielded pairs.
    - a. Conductor size: 18 AWG minimum.
    - b. Terminate shield drain conductors to ground only at one (1) end of the cable.
  10. High precision 250 ohm resistors with 0.25 percent accuracy shall be used where 4-20 mA DC analog signals are converted to 1-5 Vdc signals.
    - a. Resistors located at terminal strips.
    - b. Resistors terminated using individual terminal blocks and with no other conductors.
    - c. Resistor leads shall be un-insulated and of sufficient length to allow test or calibration equipment (e.g., HART communicator, loop calibrator) to be properly attached to the circuit with clamped test leads.
  11. Analog signals for devices in separate enclosures shall not be wired in series.
    - a. Loop isolators shall be used where analog signals are transmitted between control enclosures.
  12. Wire and cable identification:
    - a. Wire and cables numbered and tagged at each termination.
    - b. Wire tags:
      - 1) Slip-on, PVC wire sleeves with legible, machine-printed markings.
      - 2) Adhesive, snap-on, or adhesive type labels are not acceptable.
    - c. Markings as identified in the Shop Drawings.
- E. Grounding Requirements:
1. Equipment grounding conductors shall be separated from incoming power conductors at the point of entry.
  2. Minimize grounding conductor length within the enclosure by locating the ground reference point as close as practical to the incoming power point of entry.
  3. Bond electrical racks, chassis and machine elements to a central ground bus.

- 1 a. Nonconductive materials, such as paint, shall be removed from the area where the
- 2 equipment contacts the enclosure.
- 3 4. Bond the enclosure to the ground bus.
- 4 a. It is imperative that good electrical connections are made at the point of contact
- 5 between the ground bus and enclosure.
- 6 5. Panel-mounted devices shall be bonded to the panel enclosure or the panel grounding
- 7 system by means of locknuts or pressure mounting methods.
- 8 6. Sub-panels and doors shall be bonded to ground.
- 9 F. Termination Requirements:
- 10 1. Wiring to circuits external to the panel connected to interposing terminal blocks.
- 11 2. Terminal blocks rigidly mounted on DIN rail mounting channels.
- 12 3. Terminal strips located to provide adequate space for entrance and termination of the field
- 13 conductors.
- 14 4. One (1) side of each strip of terminal blocks reserved exclusively for the termination of field
- 15 conductors.
- 16 5. Terminal block markings:
- 17 a. Marking shall be the same as associated wire marking.
- 18 b. Legible, machine-printed markings.
- 19 c. Markings as identified in the shop drawings.
- 20 6. Terminal block mechanical characteristics, and electrical characteristics shall be in
- 21 accordance with NEMA ICS 4.
- 22 7. Terminal blocks with continuous marking strips.
- 23 a. Each terminal block shall be identified with machine printed labels.
- 24 8. Terminals shall facilitate wire sizes as follows:
- 25 a. 120 Vac applications: Conductor size 12 AWG minimum.
- 26 b. Other: Conductor size 14 AWG minimum..
- 27 9. Analog signal cable shield drain conductors shall be individually terminated.
- 28 10. Install minimum of 20 percent spare terminals.
- 29 11. Bladed, knife switch, isolating type terminal blocks where control voltages enter or leave
- 30 the panel.
- 31 12. Fused terminal blocks shall be used in the following circuits:
- 32 a. Control voltage is used to energize a solenoid valve.
- 33 b. DC power is connected to 2-wire, loop-powered instruments.
- 34 13. Fused terminal blocks shall be provided with blown fuse indicators.
- 35 14. When control circuits require more than one (1) field conductor connected to a single wiring
- 36 point, a sufficient number of terminal points shall be connected internally to allow
- 37 termination of only one (1) field conductor per terminal block.
- 38 15. DIN rail mounting channels shall be installed along full length of the terminal strip areas to
- 39 facilitate future expansion.
- 40 16. Connections to devices with screw type terminals shall be made using spade-tongue,
- 41 insulated, compression terminators.
- 42 G. Component Mounting and Placement:
- 43 1. Components shall be installed per manufacturer instructions.
- 44 2. Control relays and other control auxiliaries shall be mounted on DIN rail mounting channels
- 45 where practical.
- 46 3. Front panel devices shall be mounted within a range of 40 to 70 IN above the finished floor,
- 47 unless otherwise shown in the Contract Documents.
- 48 4. PLC/RTU and I/O rack installation:
- 49 a. Located such that the LED indicators and switches are readily visible with the panel
- 50 door open.
- 51 b. Located such that repair and/or replacement of component can be accomplished without
- 52 the need to remove wire terminations or other installed components.
- 53 5. Locate power supplies with sufficient spacing for circulation of air.

6. Where components such as magnetic starters, contactors, relays, and other electromagnetic devices are installed within the same enclosure as the PLC/RTU system components, provide a barrier of at least 6 IN of separation between the "power area containing the electromagnetic devices" and the "control area".
  7. Components mounted in the panel interior shall be fastened to an interior sub-panel using machine screws.
    - a. Fastening devices shall not project through the outer surface of the panel enclosure.
  8. Excess mounting space of at least 20 percent for component types listed below to facilitate future expansion:
    - a. Fuse holders.
    - b. Circuit breakers.
    - c. Control relays.
    - d. Time delay relays.
  9. Components installed on sub-panels shall be provides with a minimum spacing between component and wire duct of 1 IN.
    - a. Minimum of 2 IN separation between terminal strips and wire ducts.
- H. Power Distribution:
1. Main incoming power circuits shall be protected with a thermal magnetic circuit breaker.
    - a. Limit load to maximum of 80 percent of circuit breaker rating.
  2. Component types listed below shall be individually fused so that they may be individually de-energized for maintenance:
    - a. PLC/RTU power supply modules.
    - b. Single-loop controllers.
    - c. Recorders.
    - d. Alarm annunciators.
  3. Each control panel with PLC/RTU components shall be furnished with power protection in the form of a double conversion UPS.
  4. Equip each panel with necessary power supplies with ratings required for installed equipment and with minimum 25 percent spare capacity.
  5. Constant voltage transformers, balancing potentiometers, and rectifiers as necessary for specific instrument requirements.
- I. Internal Panel Lighting and Service Receptacles:
1. Panels less than or equal to 4 FT wide:
    - a. One (1) electrical GFCI duplex receptacle.
    - b. One (1) compact fluorescent light fixture with manual switch(es).
  2. Panels or panel faces greater than 4 FT wide:
    - a. One (1) duplex electrical GFCI receptacle per 6 FT of length.
    - b. Continuous fluorescent lighting strip with manual switches.
- J. Environmental Controls:
1. Outdoor panels:
    - a. Outdoor temperature range of 0 DegF through 120 DegF.
    - b. Thermostat controlled heaters to maintain temperature approximately 10 DegF above ambient for condensation prevention inside the panels.
    - c. Thermostat controlled closed-loop heat exchangers or closed-loop air conditioners if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the panel.
    - d. Internal corrosion inhibitors.
  2. Environmental control components:
    - a. Panel heaters:
      - 1) Thermostat controlled.
      - 2) Fan driven.
      - 3) Components mounted in an anodized aluminum housing.
      - 4) Designed for sub-panel mounting.
      - 5) Powered from 120 Vac and protected with a dedicated circuit breaker.

- b. Cooling fans and exhaust packages:
  - 1) Cooling fan with louver or grill and replaceable filter.
  - 2) Designed to be mounted within a panel cutout to provide positive airflow through the panel.
  - 3) Cooling fan and exhaust louvers shall be designed and listed to maintain a NEMA 12 enclosure rating.
  - 4) Fitted with replaceable, high-density foam or synthetic fiber.
  - 5) Cooling fan controlled with a separately mounted thermostat with bi-metal sensor and adjustable dial for temperature setting.
  - 6) Powered from 120 Vac and protected with a dedicated circuit breaker.
- c. Heat exchangers and air conditioners:
  - 1) Dual-loop design to isolate panel interior air from exterior air.
  - 2) Thermostat controlled.
  - 3) Operate from 120 Vac and protected with a dedicated circuit breaker.
- d. Internal corrosion inhibitors:
  - 1) Contains chemical which vaporizes and condenses on surfaces in the enclosure.
  - 2) Inhibitor shall be applied in accordance with manufacturer instructions for the enclosure volume.
  - 3) Inhibitor shall be applied in the panel(s) prior to shipment from the Contractor's factory.

## **2.4 MAINTENANCE MATERIALS**

- A. Extra Materials:
  - 1. Quantity of 25 percent replacement lamps for each type installed (minimum of 12 of each type).
  - 2. Minimum 12 replacement filters for each type installed.
  - 3. One (1) quart of exterior finish touch-up paint.
  - 4. One (1) complete set of replacement corrosion inhibitors in sealed packages for each panel.

## **PART 3 - EXECUTION**

### **3.1 FACTORY TESTING**

- A. Scope: Inspect and test entire panel assembly to verify readiness for shipment.
- B. Location: Contractor's factory.
- C. Factory Tests:
  - 1. Tests shall be fully documented and signed by the Contractor's factory supervisor.
  - 2. The panel shop shall fully test the control panel for correct wiring.
    - a. Each I/O point shall be checked by measuring or connecting circuits at the field terminal blocks.
  - 3. Burn-in test: Panel(s) shall be fully energized for a minimum period of 48 HRS.
  - 4. A PLC Central Processing Unit (CPU) shall be obtained and connected to the panel(s) if necessary for testing purposes.
  - 5. Testing equipment (such as digital multi-meters, analog loop calibrators, and laptop computers with PLC programming software) shall be used as required for testing.
  - 6. The following functions shall be tested as a minimum:
    - a. Demonstrate functions of the panel(s) required by the Contract Documents.
    - b. Correctness of wiring from all panel field terminals to all I/O points and to all panel components.
    - c. Simulate and test each discrete signal at the field terminal strips.
    - d. Simulate and test each analog signal using loop calibrators.
    - e. Correct operation of communications between PLC system Central Processing Units (CPUs) and Remote I/O bases.
    - f. Correct operation of single-loop controllers (including digital communication to microprocessor based devices).

- g. Correct operation of all digital communication devices.
- h. Demonstrate online and offline diagnostic tests and procedures.
- i. The Contractor shall notify the Engineer in writing a minimum of 15 calendar days prior to the Factory Tests.
  - 1) Engineer has the option to witness all required tests.
- 7. Make following documentation available to the Engineer at test site during the tests:
  - a. Contract Documents.
  - b. Factory Demonstration Testing procedures.
  - c. List of equipment to be testing including make, model, and serial number.
  - d. Shop Drawing submittal data for equipment being tested.
- 8. Deficiencies shall be corrected prior to shipment from the Contractor's factory.

### **3.2 INSTALLATION**

- A. Install free-standing panels on 4 IN high concrete housekeeping pads.
- B. Anchor panels in a manner to prevent the enclosure from racking, which may cause the access doors to become misaligned.
- C. Obtain approved panel layouts prior to installation of conduits.
- D. Install products in accordance with manufacturer's instructions.

**END OF SECTION**

**SECTION 40 99 00**  
**SURGE PROTECTION DEVICES (SPD) FOR INSTRUMENTATION**  
**AND CONTROL EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Type IC1 SPD - Dedicated 120 Vac circuit, series connection, control panel mounted.
2. Type IC3 SPD - Discrete 120 Vac control signal, control panel mounted.
3. Type IC5 SPD - Analog instrumentation signal, control panel mounted.
4. Type IC6 SPD - Combination 120 Vac circuit and analog signal, field mounted.
5. Type IC7 SPD - Discrete low voltage control signal, control panel mounted.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.

**1.2 QUALITY ASSURANCE**

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
2. National Electrical Manufacturers Association (NEMA):
  - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - b. LS 1, Low Voltage Surge Protection Devices.
3. Underwriters Laboratories, Inc. (UL):
  - a. 497B, Standard for Safety Protectors for Data Communications and Fire-Alarm Circuits.
  - b. 1449, Standard for Safety Transient Voltage Surge Suppressors.

B. Qualifications:

1. Provide devices for a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
2. Upon request, suppliers or manufacturers shall provide a list of not less than three (3) customer references showing satisfactory operation.

**1.3 DEFINITIONS**

- A. Clamping Voltage: The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge when the applied surge is induced at the 90 degree phase angle of the applied system frequency voltage.
- B. Let-Through Voltage: The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge when the applied surge is induced at the 90 degree phase angle of the applied system frequency voltage.
- C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.
- D. Maximum Surge Current:
  1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 percent deviation of clamping voltage at a specified surge current.

2. Listed by mode, since number and type of components in any SPD may vary by mode.
- E. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).
- F. Surge Current per Phase:
1. The per phase rating is the total surge current capacity connected to a given phase conductor.
  2. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
    - a. The N-G mode is not included in the per phase calculation.
- G. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 120 V system the L-N peak voltage is 170 V).

#### 1.4 SUBMITTALS

- A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  2. For named products, submit only a catalog cut sheet.
    - a. For all other products, submit the data required below.
  3. See Specification Section 40 90 00.
  4. Product technical data for non-specified models:
    - a. Manufacturer's experience.
    - b. Standard catalog cut sheet.
    - c. Electrical and mechanical drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
    - d. Create a Product Data Sheet for each different model number of SPD provided.
      - 1) Data in the Product Data Sheet heading:
        - a) SPD Type per PART 2 of the Specification.
        - b) Manufacturer's Name.
        - c) Product model number.
      - 2) Data in the Product Data Sheet body:
        - a) Column one: Specified value/feature of every paragraph of PART 2 of the Specification.
        - b) Column two: Manufacturer's certified value confirming the product meets the specified value/feature.
      - 3) Data in the Product Data Sheet closing:
        - a) Signature of the manufacturer's official (printed and signed).
        - b) Title of the official.
        - c) Date of signature.
- B. Operation and Maintenance Manuals:
1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.

#### 1.5 WARRANTY

- A. The manufacturer shall provide a minimum of a five (5) year Limited Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers model numbers listed in the individual product paragraphs below are acceptable.

### 2.2 TYPE IC1 SPD

- A. Approved Products:
1. Eaton AGSHW CH-120N-15-XS.
  2. EDCO HSP121BT-1RU.
  3. MTL MA15/D/1/SI.
  4. Phoenix Contact SFP 1-20/120AC (2856702).
- B. Standards: UL 1449.
- C. Design:
1. General:
    - a. Mounted internally to control panels for point-of-use loads.
    - b. MOV based or multi-stage hybrid solid state high performance suppression system.
    - c. Designed for series connection.
    - d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
    - e. Field connection: Provide unit with external terminal screws for each phase, neutral and ground that will accept #14 through #12 conductors.
    - f. Device monitoring: Long-life, solid state, externally visible indicators that monitors the on-line status of the units suppression filter system or power loss in any of the phases.
  2. Operating voltage: 120 Vac.
  3. Operating current: 15 A minimum.
  4. Operating frequency: 45 to 65 Hz.
  5. Modes of protection: All modes, L-N, L-G and N-G.
  6. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
  7. Maximum surge current: 20,000A per phase, 10,000A per mode minimum.
  8. Minimum repetitive surge current capacity: 1000 impulses with no degradation of more than 10 percent deviation of the clamping voltage.
  9. Fusing: Optional integral unit level and/or component level short circuit and/or thermal overload protection.
    - a. External protection as recommended by manufacturer.
  10. Maximum clamping voltages, dynamic test with voltages measured from the zero voltage reference and 90 degree phase angle:

IEEE C62.41				
System Voltage	Test Mode	B Comb. Wave	A Ring Wave	UL 1449
L-N = 120 V	L-N	400 V	300 V	330 V
	L-G	500 V	400 V	400 V
	N-G	500 V	400 V	400 V

### 2.3 TYPE IC3 SPD

- A. Approved Products:
1. EDCO DRS-130RMS.
  2. MTL MA-15/D/1/SI.
  3. MTL SD-150X.
  4. Phoenix Contact PT 2x1VA-120AC-ST (2839185) with PT BE/FM (2839282) base for non-isolated wiring.
  5. Phoenix Contact PT-2 PE/S-120 AC-ST (2839334 with PT-BE/FM (2839282) base for isolated wiring.
- B. Standards: UL 497B or UL 1449.

- C. Design:
1. General:
    - a. Mounted internally to control panels for point-of-use loads.
    - b. Multi-stage hybrid solid state high performance suppression system.
    - c. Designed for series connection.
    - d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
    - e. Field connection: Provide unit with external terminal screws for each phase, neutral and ground that will accept #14 through #12 conductors.
    - f. Device monitoring: Long-life, solid state, externally visible indicators that monitors the on-line status of the units suppression filter system or power loss in any of the phases.
  2. Operating voltage: 120 Vac.
  3. Operating current: 3 A minimum.
  4. Operating frequency: 45 to 65 Hz.
  5. Modes of protection: L-N; when ground conductor is present L-G and N-G.
  6. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
  7. Maximum surge current: 6000 A per phase, 3000A per mode minimum.
  8. Minimum repetitive surge current capacity:
    - a. The SPD shall meet one (1) of the following:
      - 1) 1000 occurrences of a 200A, 10x1000 microsecond waveform.
      - 2) 400 occurrences of a 500A, 10x1000 microsecond waveform.
      - 3) 100 occurrences of a 400A, 10x700 microsecond waveform.
      - 4) 100 occurrences of a 2000A, 8x20 microsecond waveform.
  9. Maximum clamping voltages, measured from the zero voltage reference:
    - a. The SPD shall meet one (1) of the following:
      - 1) 400A, 10x700 microsecond waveform: 200 percent of system voltage.
      - 2) IEEE B3 combination wave: 250 percent of system voltage.
      - 3) IEEE B3 ring wave: 200 percent of system peak voltage.
      - 4) IEEE A3 ring wave: 200 percent of system peak voltage.
      - 5) Mode N-G clamping voltage may be 175 percent higher than the L-G levels.

## 2.4 TYPE IC5 SPD

- A. Approved Products:
1. Eaton DHW2P036.
  2. EDCO DRS-036 or PC642C-036 with PCB1B base.
  3. MTL SD32 or SD32X.
  4. Phoenix Contact PT 2x2-24DC-ST (2838228) with PT 2x2-BE (2838208) or PT 2x2+F-BE (2839224) base.
- B. Standards: UL 497B.
- C. Design:
1. General:
    - a. Mounted internally to control panels for protection of equipment connected to analog signal loops.
    - b. Multi-stage hybrid solid state high performance suppression system.
    - c. Designed for series connection.
    - d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
    - e. Field connection: The unit shall have external terminal screws for line and ground conductors.
  2. Operating voltage: 24 Vdc or as indicated on the Drawings.
  3. Modes of protection: All modes, L-L and L-G.
  4. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
  5. Maximum surge current: 10,000 A.
  6. Minimum repetitive surge current capacity:
    - a. The SPD shall meet one (1) of the following:
      - 1) 1000 occurrences of a 200A, 10 x 1000 microsecond waveform.
      - 2) 400 occurrences of a 500A, 10 x 1000 microsecond waveform.

- 3) 100 occurrences of a 400A, 10 x 700 microsecond waveform.
- 4) 100 occurrences of a 2000A, 8 x 20 microsecond waveform.
- 5) 10 occurrences of a 10,000A, 8 x 20 microsecond waveform.
7. Maximum clamping voltages, L-L:
  - a. The SPD shall meet one (1) of the following:
    - 1) 400A, 10x700 microsecond waveform: 400 percent of system voltage.
    - 2) 10,000A, 8x20 microsecond waveform: 400 percent of system voltage.
    - 3) IEEE B3 combination wave: 225 percent of system voltage.
8. Maximum clamping voltages, L-G:
  - a. The SPD shall meet one (1) of the following:
    - 1) 400A, 10x700 microsecond waveform: 200 percent of system voltage.
    - 2) 10,000A, 8x20 microsecond waveform: 200 percent of system voltage.
    - 3) IEEE B3 combination wave: 300 percent of system voltage.

## 2.5 TYPE IC6 SPD

- A. Approved Products:
  1. EDCO SLAC-12036.
  2. MTL TPAC-4W.
  3. Phoenix Contact BXT-N4X 4-Wire.
- B. Product:
  1. Field mounted for protection of field mounted equipment connected to 120V power and 4-20mA analog signal loops.
  2. Type IC1 and Type IC5 SPDs mounted in a common enclosure.
  3. Enclosure: Metallic or nonmetallic NEMA 4X.

## 2.6 TYPE IC7 SPD

- A. Approved Products:
  1. Eaton DDIN Series.
  2. EDCO DRS Series.
  3. MTL SD Series.
  4. Phoenix Contact: PT Series.
- B. Standards: UL 497B.
- C. Design:
  1. General:
    - a. Mounted internally to control panels for protection of equipment connected to a discrete signal.
    - b. Multi-stage hybrid solid state high performance suppression system.
    - c. Designed for series connection.
    - d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
    - e. Field connection: Provide unit with external terminal screws for line and ground conductors.
  2. Operating voltage: 24 Vdc or 24 Vac or 120 Vac or as indicated on the Drawings.
  3. Modes of protection: All modes:
    - a. AC applications: L-N, L-G, N-G
    - b. DC applications: Pos-Neg, Pos-Gnd, Neg-Gnd.
  4. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
  5. Maximum surge current: 10,000 A.
  6. Minimum repetitive surge current capacity:
    - a. The SPD shall meet one (1) of the following:
      - 1) 1000 occurrences of a 200A, 10 x 1000 microsecond waveform.
      - 2) 400 occurrences of a 500A, 10 x 1000 microsecond waveform.
      - 3) 100 occurrences of a 400A, 10 x 700 microsecond waveform.
      - 4) 100 occurrences of a 2000A, 8 x 20 microsecond waveform.
      - 5) 10 occurrences of a 10,000A, 8 x 20 microsecond waveform.

7. Maximum clamping voltages, L-L (Pos-Neg):
  - a. The SPD shall meet one (1) of the following:
    - 1) 400A, 10x700 microsecond waveform: 400 percent of system voltage.
    - 2) 10,000A, 8x20 microsecond waveform: 400 percent of system voltage.
    - 3) IEEE B3 combination wave: 250 percent of system voltage.
8. Maximum clamping voltages, L-G:
  - a. The SPD shall meet one (1) of the following:
    - 1) 400A, 10x700 microsecond waveform: 200 percent of system voltage.
    - 2) 10,000A, 8x20 microsecond waveform: 200 percent of system voltage.
    - 3) IEEE B3 combination wave: 300 percent of system voltage.

## 2.7 SOURCE QUALITY CONTROL

- A. Performance tests to be performed or independently verified by a certified testing laboratory.
- B. The SPD are to be tested as a complete SPD system including: Integral unit level and/or component level fusing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Type IC1 SPD:
  1. Provide on the following applications:
    - a. Incoming 120 V power to all control panels.
    - b. Line side of 120 V power terminals to equipment (e.g., PLCs, transmitters).
  2. Connected in series with the panel's or equipment's branch circuit.
  3. Provide fuse protection as recommended by manufacturer.
  4. Flange mount or DIN rail mount in control panel.
  5. Connect all SPDs in the panel to the same grounding point.
- C. Type IC3 SPD:
  1. Provide on the following applications:
    - a. 120 V discrete RTU signals into a control panel from float switches, position switches, etc., where the device is mounted outdoors or in a remote building or structure from the control panel and where the control conductors are routed above grade or underground.
    - b. 120 V discrete RTU signals into a control panel from float switches, position switches, etc., where both the device and control panel are mounted outdoors and the control conductors are routed above grade or underground.
  2. Connected in series with the equipment.
  3. Provide fuse protection as recommended by manufacturer.
  4. Flange mount or DIN rail mount in control panel.
  5. Connect all SPDs in the panel to the same grounding point.
- D. Type IC5 SPD:
  1. Provide on the following applications:
    - a. Incoming 4-20mA signals into a control panel from transmitters (flow, level, etc.) where the transmitter is mounted outdoors or in a remote building or structure from the control panel and the signal conductors are routed above grade or underground.
    - b. Incoming 4-20mA signals into a control panel from transmitters (flow, level, etc.) where both the transmitter and control panel are mounted outdoors and the signal conductors are routed above grade or underground.
  2. Connect in series with the equipment.
  3. Flange mount or DIN rail mount in control panel.
  4. Connect all SPDs in the control panel to the same grounding point.
  5. Verify SPDs series resistance and capacitance does not interfere with the transmitters signal.

- 1 E. Type IC6 SPD:
- 2 1. Provide on the following applications:
- 3 a. Outdoor field mounted transmitter (flow, level, etc.) that requires 120 V power and
- 4 provides a 4-20mA signal to a control panel where the conductors are routed above
- 5 grade or underground.
- 6 2. Connect in series with the equipment.
- 7 3. Mounted adjacent to equipment.
- 8 4. Bond transmitter to a grounded structure or provide a ground rod.
- 9 5. Ground shield at control panel end.
- 10 6. Verify SPDs series resistance and capacitance does not interfere with the transmitters signal.
- 11 F. Type IC7 SPD:
- 12 1. Provide on the following applications:
- 13 a. Low voltage (e.g., 24 Vac, 24 Vdc) discrete RTU signals into a control panel from float
- 14 switches, position switches, etc., where the device is mounted outdoors or in a remote
- 15 building or structure from the control panel and where the control conductors are routed
- 16 above grade or underground.
- 17 b. Low voltage (e.g., 24 Vac, 24 Vdc) discrete RTU signals into a control panel from float
- 18 switches, position switches, etc., where both the device and control panel are mounted
- 19 outdoors and the control conductors are routed above grade or underground.
- 20 2. Connect in series with the equipment.
- 21 3. Flange mount or DIN rail mount in control panel.
- 22 4. Connect all SPDs in the control panel to the same grounding point.

23 **END OF SECTION**



**SECTION 43 21 00**  
**PUMPING EQUIPMENT: BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Pumping equipment.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 09 91 00 - Painting and Protective Coatings.
  - 4. Section 40 05 05 - Equipment: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. Hydraulic Institute (HI):
    - a. 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
- B. Fully coordinate all mechanical seal systems specified to ensure pump and seal compatibility.

**1.3 DEFINITIONS**

- A. The abbreviations are defined as follows:
  - 1. IPS: Iron Pipe Size.
  - 2. NPSHR: Net Positive Suction Head Required.
  - 3. TDH: Total Dynamic Head.
  - 4. TEFC: Totally Enclosed Fan Cooled.
- B. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

**1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. See Specification Section 40 05 05.
  - 3. Product technical data including:
    - a. Performance data and curves with flow (gpm), head (FT), horsepower, efficiency, NPSH requirements, submergence requirement.
    - b. Pump accessory data.
    - c. Bearing supports, shafting details and lubrication provisions.
      - 1) Bearing life calculations.
      - 2) Critical speed calculations.
    - d. Solids passage information.
  - 4. Certifications:
    - a. Certified pump performance curves as described in the SOURCE QUALITY CONTROL Article.
  - 5. Test reports:
    - a. Factory hydrostatic test.
- B. Operation and Maintenance Manuals:
  - 1. See Specification Section 01 33 04 for requirements for:

- 1                   a. The mechanics and administration of the submittal process.
- 2                   b. The content of Operation and Maintenance Manuals.
- 3       C. Informational Submittals:
- 4           1. Certifications:
- 5               a. Provide a written statement that manufacturer's equipment has been installed properly,
- 6                 started up and is ready for operation by Owner's personnel.

## 7   **PART 2 - PRODUCTS**

### 8   **2.1 ACCEPTABLE MANUFACTURERS**

- 9       A. Subject to compliance with the Contract Documents, the following manufacturers are
- 10         acceptable:
- 11           1. Pumps:
- 12               a. See individual pump Specification Sections.
- 13       B. Submit request for substitution in accordance with Specification Section 01 25 13.

### 14   **2.2 CENTRIFUGAL PUMP DESIGN**

- 15       A. Provide units with increasing head characteristics from the end run out portion of the curve to
- 16         shut-off condition.

### 17   **2.3 ACCESSORIES**

- 18       A. See Specification Section 40 05 05.
- 19       B. Each Unit:
- 20           1. Lifting eye bolts or lugs.
- 21           2. Plugged gage cock connection at suction and discharge nozzles.
- 22           3. Tapped and plugged openings for casing and bearing housing vents and drains.
- 23           4. Fittings for properly adding flushing lubricant.
- 24           5. Pressure relief fittings for grease lubrication.
- 25       C. Packing Seal:
- 26           1. Provide packing unless mechanical seal is specified in narrow-scope pump sections.
- 27           2. Minimum of five (5) rings graphite impregnated synthetic packing.
- 28           3. Provide minimum 1/4 IN DIA supply tap and 1/2 IN DIA minimum drain tap.
- 29           4. Provide split Teflon or bronze water seal ring.
- 30           5. Adjustable split follower cast iron or bronze gland.

### 31   **2.4 FABRICATION**

- 32       A. Pump Support:
- 33           1. Design base to support weight of drive, shafting and pump.
- 34           2. Comply with HI vibration limitations.
- 35           3. Mount horizontal pump, motor and coupling on single piece drip lip type baseplate.
- 36           4. Mount vertical pumps on single piece pedestal baseplate.
- 37           5. Fabricate to withstand all operating loads transmitted from the pump and drive.

### 38   **2.5 SOURCE QUALITY CONTROL**

- 39       A. If specifically required in the individual pump specification sections, provide factory tests:
- 40           1. All units:
- 41               a. Conduct tests in accordance with HI.
- 42                   1) Shut-off head and design condition: Positive unilateral performance tolerance
- 43                     meeting Grade 1U per HI 14.6.
- 44               b. Hydrostatic test at 150 percent of shut-off head for a minimum of 5 minutes.

- 1           2. Constant speed units:
  - 2           a. Head (FT) versus flow (gpm) pump curves:
    - 3           1) Efficiencies along curve.
    - 4           2) Brake horsepower along each curve.
  - 5           3. Results certified by a registered professional engineer.
- 6       B. Statically and dynamically balance each pump per HI standards.

## 7 PART 3 - EXECUTION

## 8 3.1 INSTALLATION

- 9 A. See Specification Section 40 05 05.
- 10 B. Submersible Units:
- 11 1. Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint
- 12 installed and tightened.
- 13 a. Test alignment by loosening flange bolts to see if there is any change in relationship of
- 14 piping flange with equipment connecting flange.
- 15 b. Realign as necessary, install flange bolts and make equipment connection.
- 16 2. Field paint units as defined in Specification Section 09 91 00.
- 17 3. Provide pressure gage on discharge of all pumps and on suction and discharge of all non-
- 18 submersible units.

## 19 3.2 FIELD QUALITY CONTROL

- A. Provide services of equipment manufacturer's field service representative(s) to:
1. Inspect equipment covered by this Specification Section.
  2. Supervise pre-start adjustments and installation checks.
  3. Conduct initial startup of equipment and perform operational checks.
  4. Instruct Owner's personnel for the specified minimum number of hours at jobsite per Specification Section 01 30 00 on operation and maintenance of each of following pumping equipment:

28 **END OF SECTION**



**SECTION 43 21 22**  
**PUMPING EQUIPMENT: SUBMERSIBLE NON-CLOG**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Submersible non-clog pumps:
    - a. Wet pit application.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 2. Division 01 - General Requirements.
  - 3. Section 09 91 00 - Painting and Protective Coatings.
  - 4. Section 43 21 00 - Pumping Equipment: Basic Requirements.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Bearing Manufacturers Association (ABMA).
  - 2. American National Standards Institute (ANSI).
  - 3. ASTM International (ASTM):
    - a. A48, Standard Specification for Gray Iron Castings.
  - 4. FM Global (FM).
  - 5. Hydraulic Institute (HI):
    - a. Standards for Centrifugal, Rotary and Reciprocating Pumps.
  - 6. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 7. National Fire Protection Agency (NFPA):
    - a. 70, National Electrical Code (NEC).
  - 8. Underwriters Laboratories, Inc. (UL).

**1.3 SYSTEM DESCRIPTION**

- A. Treated effluent reuse water utilizing storage tank level controlled pump from reuse wet well to reuse storage facility.
- B. Provide single source coordination responsibility through the pump manufacturer for the entire system including but not limited to the following:
  - 1. Pumps.
  - 2. Motors.
  - 3. Control Panel.

**1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
  - 2. Requirements in Specification Section 43 21 00.
  - 3. Source quality control test reports.
- B. Operation and Maintenance Manuals:
  - 1. See Specification Section 01 33 04 for requirements for:
    - a. The mechanics and administration of the submittal process.
    - b. The content of Operation and Maintenance Manuals.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Effluent Reuse Transfer Pumps:
  - a. Flygt.

### **2.2 MATERIALS**

A. Wet Pit Applications:

1. Pump case: Cast iron, ASTM A48, Class 30.
2. Motor housing: Cast iron, ASTM A48, Class 25 or Class 30.
3. Impeller: Cast iron, ASTM A48, Class 30.
4. Shaft:
  - a. Stainless steel, ANSI, Series 300 or 400.
  - b. Carbon steel C1035 is acceptable if not contacting pumped fluid.
5. Wear rings: Corrosion and wear resistant materials.
6. O-rings: Nitrile (Buna-N).
7. Fasteners and lifting handle: Stainless steel.
8. Guide rails: 304 stainless steel.
9. Lifting chains and cables: 304 stainless steel.
10. Lower ring seal: Tungsten-carbide both faces. All seal rings to be individual solid sintered rings.
11. Upper ring seal: Corrosion resistant Tungsten-carbide both faces. All seal rings to be individual solid sintered rings.
12. Seal metal parts: Stainless steel.
13. Pump Base: Cast iron.
14. Epoxy Phenolic: Applied to pump housing and elbows.

### **2.3 EQUIPMENT**

A. Performance and Configuration Requirements:

1. Effluent Reuse Transfer Pump Quantity = 2 (1 installed, 1 shelf spare):
  - a. Design condition: 900 gpm at 90 FT TDH with minimum pump efficiency of 75 percent.
  - b. Shutoff condition: 0 gpm at 160 FT.
  - c. Pump configuration:
    - 1) Submersible wet pit.
    - 2) Counter-clockwise rotation when viewed from the driver end.
  - d. Maximum pump speed: 1,800 rpm.
  - e. Nameplate driver horsepower: 35.
  - f. Drive type: Constant speed.
  - g. Minimum solids passage: 3 IN.
  - h. Discharge elbow: 4 IN DIA.
  - i. Motor requirements:
    - 1) Service factor: 1.15.
    - 2) Minimum motor efficiency: 85 percent.
    - 3) Minimum power factor: 80 percent.
    - 4) Maximum horsepower: 35.
  - j. Ambient conditions:
    - 1) Treated wastewater effluent maximum temperature: 80 DegF.
    - 2) Air maximum temperature: 100 DegF.

## 2.4 COMPONENTS

### A. General:

1. Provide pumps capable of handling raw, unscreened sewage.
2. Where watertight sealing is required, machine and fit mating surfaces with O-rings.
3. Provide with heavy duty lift lugs or hoisting bail designed for lifting the entire pump and motor assembly.

### B. Impeller:

1. Provide nonclog-type dynamically balanced, semi-open multivane, backswept, impeller in accordance with HI standards.
2. Provide impeller and volute wear rings as necessary to assure efficient sealing between volute and impeller.
3. Impeller to volute clearance to be readily adjustable with a single trim screw.
4. Leading edges of the gray iron impeller shall be hardened to Rc 45.

### C. Shaft:

1. Design pump shaft of sufficient size to transmit full driver output.
2. Use shaft which is accurately machined and constructed with sufficient materials.
3. Design shaft for a maximum deflection of 0.002 IN measured at the stuffing box.

### D. Shaft Seal:

1. Seal shaft with two independent, tandem mounted seals running in an oil filled chamber.
2. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
3. Hold interface in contact by its own spring system.
4. The rotating seal ring to have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber.

### E. Bearings:

1. Support shaft on upper and lower permanently lubricated bearings with a minimum ABMA L-10 life of 100,000 HRS.
2. Upper bearing to be two row angular contact bearing.
3. Lower bearing to be two row angular contact bearing-single row lower bearing not acceptable.

### F. Motors:

1. Provide pump with FM or UL listed motor designed for area classification shown on Drawings.
2. Provide motor of totally submersible design, constructed with class H monomer-free polyester resin encapsulated windings with a 95% winding fill factor, air-filled, with Class F insulation and rated for continuous duty operation, completely submerged or unsubmerged.
3. Motor shall be 460V/ 3 PH/ 60 HZ.
4. Assure motor is capable of running dry for extended periods without damage to motor or seal when operating submerged or unsubmerged in 104 Deg F ambient.
5. Motor to be rated for 30 evenly spaced starts per hour.
6. Capable of continuous operation submerged or un-submerged.
7. Non-overloading throughout pump curve.
8. Provide motor leakage switch or a conductivity type moisture probe located in sealing chamber.
9. Provide motor that is inverter duty rated in accordance with NEMA MG1, Part 31.

### G. Power and Control Cables:

1. Provide power cable and control cable to pump suitable for submersible applications in wastewater and indicate same by a code or legend permanently embossed on cables.
2. Size cables in accordance with applicable NEC specifications.

- 1 3. Provide power cable and control cable of sufficient length to reach power outlets without
- 2 splicing. See Drawings to determine required length for each application.
- 3 4. Provide each cable with a strain relief and cord grip.
- 4 H. Temperature and Moisture Monitor:
- 5 1. Furnish each phase of the motor with a temperature monitor embedded in the motor
- 6 windings.
- 7 a. Arrange controls so as to shut the pump down and sound alarm should any one of the
- 8 monitors detect high temperature and automatically reset once the stator temperature
- 9 returns to normal.
- 10 b. Set temperature of the temperature monitors at not higher than 90 percent of insulation
- 11 temperature rating.
- 12 2. Provide leak sensor as needed for detecting the presence of water in the seal chamber and
- 13 the motor housing.
- 14 a. If water enters, the sensor shall energize electrical circuit to activate alarm circuit for
- 15 external alarm.
- 16 3. Locate leakage detection sensor in separate seal leakage chamber so that any leakage will be
- 17 captured prior to entry into the motor stator housing, preventing contamination of the motor
- 18 lower bearing.
- 19 4. Outputs from the monitoring system shall include:
- 20 a. Temperature fault.
- 21 b. Moisture fault.
- 22 c. Common alarm.
- 23 5. Controls associated with these monitors will be located in the pump control panel.
- 24 I. Coatings:
- 25 1. Apply manufacturers coating system to the exterior of the pump casing and motor housing
- 26 that is equal to or better than that specified in Specification Section 09 91 00.
- 27 2. Protect all metallic surfaces coming into contact with sewage except stainless steel and
- 28 bronze by a corrosion-resistant coating of phenolic epoxy.
- 29 J. Wet Pit Applications:
- 30 1. Provide sliding guide bracket integral to pump unit which properly aligns the pump
- 31 discharge with the discharge connection elbow for watertight seal during pumping.
- 32 2. Guide the entire weight of the pumping unit by guide rail(s).
- 33 3. The guide rail(s) shall not support any portion of the weight of the pump.
- 34 4. Provide chains or cable of sufficient strength to lift pumps from sump.
- 35 5. Furnish guiding rail assembly and the discharge flange assembly of nonsparking
- 36 components.
- 37 6. Design pump to allow for removal without entering the wet well and without removal of
- 38 bolts, nuts or other fastenings.
- 39 7. Provide pump unit connecting to discharge connection with a simple downward motion
- 40 without rotation.
- 41 8. Provide necessary sliding guide bracket and discharge connection which, when bolted to the
- 42 floor of the sump and to the discharge line, will receive the pump discharge connecting
- 43 flange without need of adjustment, fasteners, clamp, or similar devices.
- 44 9. No portion of the pump shall bear directly on the floor or the wet well.

## 45 2.5 ACCESSORIES

46 A. See Specification Section 43 21 00.

47 B. Controls:

- 48 1. Pumps to be operated by their own manufacturer supplied control panel.
- 49 2. Provide two sealed float-type mercury switches to control pumps.
- 50 3. Seal mercury tube switches in a solid polypropylene float.
- 51 4. Provide float with large radius top at electrical cable connection to assure trouble-free
- 52 operation.

5. Suspend floats on their own cable.
6. Provide floats to operate at elevation shown on Drawings.
7. Design floats to be field-adjustable.
8. Two (2) floats and remote START/STOP commands from Pump Station Remote Terminal Unit (RTU) are to control pumps:
  - a. One (1) float for pump start.
  - b. One (1) float for low water cutoff.
  - c. The Pump Station RTU receives reuse storage tank level signal via radio and antenna. Upon a low level within the reuse storage tank, the Pump Station RTU shall send a START command to the pump control panel to call the pump to run. The pump shall not be allowed to run at any given time until there is both a reuse storage tank low level and the pump start float switch is activated.
  - d. Upon a reuse storage tank high level the Pump Station RTU shall send a STOP command to the pump control panel to call the pump to stop. The pump shall be called to stop upon either a reuse storage tank high level or a deactivation of the low water cutoff float switch.

C. Control Panel:

1. Furnish and install locally mounted control panel at location indicated on Drawings and rated for area classification.
2. Furnish control panel with main circuit breaker to disconnect incoming power to control panel.
3. Include combination circuit breaker type controller with short circuit, overload, and three overload relays, interior-mounted motor starter(s), and transformer with disconnect and overload protection for control circuit of 24 V.
4. Include a terminal board for connection of level float switches.
5. Provide the following features:
  - a. NEMA 4X stainless steel watertight enclosure with continuous hinge, neoprene gasket in cover and continuous seam weld. Include locking mechanism complete with padlock.
  - b. Hand-Off-Automatic selector switch for pump.
  - c. Pump running light.
  - d. Elapsed time meter.
  - e. Overload reset button to reset overload relays.
  - f. Lightning protection/surge protection.
  - g. Condensation heater.
  - h. Moisture detector alarm light and pump shutdown.
  - i. 100 watt utility light outlet.
  - j. Float switch test pushbuttons.
  - k. Auxiliary contacts wired to terminal blocks.
  - l. Power ON control relay.
  - m. Power OFF control relay.
  - n. Remote telemetering contact.
  - o. 12 Vdc alarm system: A safety device which will actuate when faced with an incoming power failure.
  - p. Inner door in cabinet-mounted on a continuous vertical steel hinge; size to completely cover wiring and components mounted on the back panel; provide for mounting of controls and instruments on inner door.
  - q. Pole mounting bracket.

D. Access Doors and Frames:

1. Furnish and install hinged doors constructed of aluminum.
2. Furnish size shown on Drawings.
3. Equip with nonsparking upper guide rail support, float bracket, and flush locking mechanism.
4. Door shall be able to remain in open position while work is being performed.
5. Securely place frame above pump(s).

- 1 6. Provide doors of skidproof design.
- 2 7. Provide doors with snap locks and removable handle.
- 3 8. Provide door hardware including latching mechanism and hinges of stainless steel materials.
- 4 9. Provide safety grating for fall through protection.

5 E. Check Valve

- 6 1. Furnish and install a ball-type check valve on each pump discharge.

7 F. Jib Crane

- 8 1. Provide stainless steel jib crane and base cable of lifting pump out of wet well.

9 **2.6 SOURCE QUALITY CONTROL**

10 A. Secure from the pump manufacturer the following inspections and tests on each pump before  
11 shipment from factory:

- 12 1. Check impeller, motor rating and electrical connections for compliance with this  
13 Specification Section.
- 14 2. Test motor and cable insulation for moisture content or insulation defects.
- 15 3. Prior to submergence, run pump dry to establish correct rotation and mechanical integrity.
- 16 4. Run pump for 30 minutes submerged, a minimum of 6 FT under water.
- 17 5. After operational test #4, perform insulation test (#2) again.

18 B. Factory test of head (FT) versus flow (gpm) for one pump of each service category as specified  
19 in Specification Section 43 21 00.

20 **PART 3 - EXECUTION**

21 **3.1 INSTALLATION**

- 22 A. See Specification Section 43 21 00.
- 23 B. For wet pit pumps, permanently install discharge connection elbow in wet well along with  
24 discharge piping.
- 25 C. Seal pump cable end with a high quality protective covering, to make it impervious to moisture  
26 or water seepage prior to electrical installation.

27 **3.2 FIELD QUALITY CONTROL**

- 28 A. See Specification Section 43 21 00.

30 **END OF SECTION**