

**CONTRACT DOCUMENTS & SPECIFICATIONS**

**UPGRADES TO  
PUMP STATION “B”**

**Prepared For:**

**TOWN OF EDISTO BEACH**

**DECEMBER 2021**



**ENGINEERING CONSULTANTS, INC.**

**1300 12th Street, Suite A • P.O. Box 2299 • Cayce, SC 29171 • (803) 791-1400 • FAX: (803) 791-8110**



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Prepared By:

**AMERICAN ENGINEERING CONSULTANTS, INC.**  
**PO Box 2299**  
**Cayce, SC 29171**  
**TEL.: (803) 791-1400      FAX: (803) 791-8110**

**AEC JOB NO. 21-028**



# DOCUMENT 00003

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## **SECTION 00020 INVITATION FOR BIDS**

The Town of Edisto Beach will receive Sealed Bids for the **Upgrades to Pump Station “B”** project until **2:00 PM on Wednesday June 22, 2022** at the Town of Edisto Beach offices at 2414 Murray Street in Edisto Beach, SC, at which time and place all Bids will be publicly opened and read aloud. Bidders shall contact the engineer to coordinate any visit to the site.

Bids are invited upon the several items and quantities of work as follows:

- Upgrades of Wastewater Pump Station “B”, including removal and replacement of existing pumps and equipment.

Contract Documents, including Drawings and Technical Specifications, are on file at the following locations:

American Engineering Consultants, Inc.  
1300 Twelfth Street, Suite A  
Cayce, SC 29033  
(PO Box 2299 / 29171)  
Telephone 803-791-1400  
lstritzinger@aec-sc.com

ConstructConnect Plan Room (ConstructConnect.com)  
Available In Online Plan Rooms Only

Dodge Data & Analytics/Dodge Construction Network Plan Room (Construction.com)  
Available In Online Plan Rooms Only

Digital copies of the Contract Documents (Drawings, Specifications and Bid Submittal Package) may be obtained upon contacting the Engineer.

This project is being partially funded by a grant from the Rural Infrastructure Authority (RIA). Bidders must be aware of and comply with all applicable state and federal requirements identified in the bid documents. The low bidder will be required to complete all required documentation and submit to the engineer within (10) days of the bid opening. RIA must review the information and approve the contractor prior to issuance of a Notice to Proceed.

The selected low bidder will be required to obtain a Building Permit based on the cost of the building addition, as well as, Electrical Permit from the Town of Edisto Beach for this project. Fees are available online from the Town of Edisto Beach website.

No bid shall be considered unless the bidder is legally qualified under the provisions of the South Carolina Contractor’s Licensing Law and has a classification of General Contractor-Public Utilities and a subclassification of Water and Sewer Lines with the appropriate License Group Limitation for the Bid amount. No bidder may withdraw his Bid within 90 consecutive days after the actual date of opening.

A certified check or bank draft payable to the order of the OWNER, negotiable U. S. Government Bonds (at par value), or a satisfactory Bid Bond executed by the Bidder and an acceptable Surety

in an amount equal to five percent ( 5%) of the total Bid shall be submitted with each Bid. The low bidder will be required to furnish a satisfactory performance bond and payment bond, each in the amount of 100% of the bid amount. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act for the surety at the time of the signing of the bond.”

OWNER reserves the right to reject any and/or all Bids or to waive any informality in the Bidding. Bids may be held by the OWNER for a period not to exceed ninety (90) days from the date of the opening of Bids for the purpose of reviewing the Bids and investigating the qualifications of Bidders, prior to awarding of the Contract.

Owner: Town of Edisto Beach

By: Iris Hill

Title: Town Administrator

**END OF SECTION**

# SECTION 00100 INSTRUCTIONS TO BIDDERS

## 1. Use of Bid Forms in Contract Documents

These contract documents include a complete set of bidding and Contract forms which are to be used by the bidders.

## 2. Interpretations and Addenda

No oral interpretations shall be made to any bidder as to the meaning of the Contract Documents or any part thereof. Every request for such an interpretation shall be made to the Engineer in writing. **Any inquiry received before the close of business on Friday, June 10, 2022 shall be given consideration.** Every interpretation made to a Bidder will be in the form of an Addendum to the Contract Documents, and when issued, shall be on file with the office of the Owner and the office of the Engineer at least five days before Bids are opened. In addition, all addenda will be mailed to each person holding Contract Documents, but it shall be the Bidders responsibility to make inquiry as to the Addenda issued. All such addenda shall become part of the Contract and all Bidders shall be bound by such addenda, whether or not received by the Bidders.

## 3. Inspection of Site

Each Bidder should visit the site of the proposed work and fully acquaint himself with the existing conditions there relating to construction and labor, and should fully inform himself as to the facilities involved and the difficulties and restrictions attending the performance of the Contract. The Bidder should thoroughly examine and familiarize himself with the Drawings, Technical Specifications, and all other Contract Documents. The Contractor, by execution of the Contract, shall in no way be relieved of any obligation under it due to his failure to receive or examine any form or legal instrument or to visit the site and acquaint himself with the conditions there existing and the Owner will be justified in rejecting any claim based on facts regarding which he should have been on notice as a result thereof.

## 4. Alternate Bids

No alternative bids will be considered unless alternative bids are specifically requested by the technical specifications

## 5. Bids

- a. All Bids must be submitted on the forms supplied by the Owner and shall be subject to all requirements of the Contract Documents, including the Drawings, and these **Instructions to Bidders**. All Bids must be regular in every respect, with no exclusions or special conditions made or included in the Bid Form by the Bidder.
- b. Contract Documents, including the Bid, the Bid Guaranty, the Statement of Bidder's Qualifications, the List of Subcontractors and Suppliers, the Non-Collusion Affidavit, and the

Certification of Nonsegregated Facilities, shall be included in the bound documents and enclosed in an envelope that shall be sealed and clearly labeled with the words "Bid Documents," Upgrades to Pump Station "B", Town of Edisto Beach – Attn: Iris Hill, name of Bidder, General Contractor's License Number, and the date and time of Bid opening. If mailed or delivered prior to the Bid opening, a second outer envelope must be used and labeled the same as the inner envelope, in order to guard against the premature opening of the Bid.

- c. The Owner may consider as irregular, any Bid on which there is an alteration or departure from the Bid Form hereto attached and at it's opinion, may reject same.
- d. If the Contract is awarded, it will be awarded by the Owner to a responsive, responsible Bidder on the basis of the lowest Bid, and the selected Alternative Bid Items, if any. The Contract will require the completion of work according to the Contract Documents.
- e. Each Bidder shall include in his Bid the following information:

**Principals**

Names  
Home Addresses, including City, State, and Zip Code

**Firm**

Name  
Federal Identification Number (FIN)  
Address, including City, State, and Zip Code

**List of all Proposed Subcontractors**

Name  
Type of Work  
Mechanical or Electrical Contractors License Number (if Applicable)

**6. Bid Guaranty**

- a. The Bid must be accompanied by a Bid Guaranty which shall not be less than five percent (5%) of the amount of the Bid. At the option of the Bidder, the guaranty may be a certified check, bank draft, negotiable U. S. Government Bond (at par value), or a Bid Bond in the form attached. The Bid Bond shall be secured by a guaranty of surety company holding certificates of authority as acceptable sureties (31 CFR 223). All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act for the surety at the time of the signing of the bond. No Bid will be considered in the absence

of the required guaranty. Certified checks or bank drafts shall be payable to OWNER. Cash deposits will not be accepted. The Bid guaranty shall insure the execution of the agreement and the furnishing of the surety bond or bonds by the successful Bidder, as required by the Contract Documents.

- b. Revised Bids submitted before the opening of Bids, whether forwarded by mail or telegram, if representing an increase in excess of two percent (2%) of the original Bid, must have the Bid guaranty adjusted accordingly, otherwise the Bid will not be considered.
- c. Certified checks or bank drafts, or the amount thereof, Bid bonds, and negotiable U. S. Government bonds of unsuccessful Bidders will be returned as soon as practical after the opening of Bids.

**7. Collusive Agreements**

- a. Each bidder submitting a Bid to the Owner for any portion of the Work contemplated by the Contract Documents on which the Bidding is based shall execute and attach thereto, an affidavit substantially in the form herein provided, to the effect that he has not entered into a collusive agreement with any other person, firm, or corporation with regard to any bid submitted.
- b. Before executing any subcontract, the successful Bidder shall submit the name of any proposed subcontractor for prior approval.

**8. Statement of Bidder's Qualifications**

Each Bidder shall submit on the form furnished for that purpose (a copy which is included in the Contract Documents), a statement of the Bidder's qualifications, his experience record in constructing the type of improvements embraced in the Contract, his organization and equipment available for the work contemplated, and, when specifically requested by the Owner, a detailed financial statement. The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform the Work according to his obligations under the Contract, and the Bidder shall furnish the Owner all such information and data for this purpose as it may request. The right is reserved to reject any Bid where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified to properly carry out the terms of the Contract.

**9. Unit Prices**

The unit price for each of the several items in the proposal of each bidder shall include its prorata share of overhead, so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price Bid represents the total Bid. Any Bid not conforming to this requirement may be rejected as informal. The special attention of all Bidders is called to this provision, for should conditions make it necessary to revise the quantities, no limit will be fixed for such increased or decreased quantities, nor extra compensation allowed, provided that the net monetary value of all such additive and subtractive changes in quantities of such items of work (i. e. difference in cost) shall not increase or decrease the original contract price by more than twenty-five percent (25%),

except Work not covered in the Drawings and Technical Specifications as provided for in the General Conditions hereof.

**10. Corrections**

Erasures or other changes in the Bids must be explained or noted over the signature of the Bidder.

**11. Time for Receiving Bid**

- a. Bids received prior to the advertised hour of opening will be securely kept, sealed. The officer whose duty it is to open them will decide when the specified time has arrived, and no Bid received thereafter will be considered, except that when a Bid arrives by mail after the time fixed for opening, but before the reading of all other bids is completed, and it is shown to the satisfaction of the OWNER that the non-arrival on time is due solely to delay in the mail for which the Bidder was not responsible, such Bid will be received and considered.
- b. Bidders are cautioned that, while telegraphic modifications of Bids may be received as provided above, such modifications, if not explicit and if in any sense subject to misinterpretation, shall make the Bid so modified or amended, subject to rejection.

**12. Opening of Bids**

At the time and place fixed for the opening of Bids, the OWNER will cause to be opened and publicly read aloud every Bid received within the time set for receiving Bids, irrespective of any irregularities therein. Bidders and other persons properly interested may be present, in person or by representative.

**13. Withdrawal of Bids**

Bids may be withdrawn on written or telegraphic request dispatched by the Bidder in time for delivery in the normal course of business to the time fixed for opening; provided, that written confirmation of any telegraphic withdrawal over the signature of the Bidder is placed in the mail and postmarked prior to the time set for Bid opening. The Bid guaranty of any Bidder withdrawing his Bid in accordance with the foregoing conditions will be returned promptly.

**14. Award of Contract: Rejection of Bids**

- a. The Contract will be awarded to the lowest responsive, responsible Bidder.
- b. The responsive, responsible Bidder or Bidders must comply with the conditions of the Invitation for Bids. The Bidder or Bidders to whom the award is made will be notified at the earliest possible date. The OWNER, however, reserves the right to reject any and all Bids and to waive any informality in Bids received whenever such rejection or waiver is in its interest.



- c. The OWNER reserves the right to consider as unqualified to do the work of general construction any Bidder who does not habitually perform with his own forces the major portions of the work involved in construction of the Improvements embraced in this Contract.

**15. Execution of Agreement: Performance and Payment Bond**

- a. Subsequent to the notice of award and within ten (10) days after the prescribed forms are presented for signature, the successful Bidder shall execute and deliver to the OWNER an Agreement in the form included in the Contract Documents in such number of copies as the OWNER may require.
- b. Having satisfied all conditions of award as set forth elsewhere in these documents, the successful Bidder shall, within the period specified in paragraph "a" above, furnish a surety bond in a penal sum not less than the amount of the Contract as awarded, as security for the faithful performance of the Contract, and for the payment of all persons, firms, or corporations to whom the Contractor may become legally indebted for labor materials, tools, equipment, or services of any nature including utility and transportation services, employed or used by him in performing the work. Such bond shall be in the same form as that included in the Contract Documents and shall bear the same date as, or a date subsequent to that of the Agreement. The current power of attorney for the person who signs for any surety company shall be attached to such bond.

This bond shall be obtained from companies holding certificates of authority as acceptable sureties.

- c. The failure of the successful Bidder to execute such Agreement and to supply the required bond or bonds within ten days after the prescribed forms are presented for signature, or within such extended period as the OWNER may grant, based upon reasons determined sufficient by the OWNER, shall constitute a default, and OWNER may either award the Contract to the next lowest responsible Bidder or readvertise for Bids, and may charge against the Bidder the difference between the amount of the Bid and the amount for which a Contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the Bid Bond. If a more favorable Bid is received by readvertising, the defaulting Bidder shall have no claim against the OWNER for a refund.

**END OF SECTION**



**SECTION 00300  
BID FORM**

**Place:**       **Town of Edisto Beach  
2414 Murray Street  
Edisto Beach, SC 29438**

**Time:**       **2:00 PM**

**Date:**       **June 22, 2022**

**THIS BID IS SUBMITTED BY:**

Bidder \_\_\_\_\_

Address \_\_\_\_\_

Contractor's License No. \_\_\_\_\_

**THIS BID IS SUBMITTED TO:**

**OWNER:**     **Town of Edisto Beach  
2414 Murray Street  
Edisto Beach, SC 29438**

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an agreement with OWNER in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents to the full satisfaction of the ENGINEER and OWNER.
2. BIDDER accepts all of the terms and conditions of the Advertisement or Invitation to Bid, Instructions to Bidders, and Supplementary Instructions to Bidders including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for ninety (90) days after the day of Bid opening. 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 ten (10) days after the date of OWNER's Notice of Award.
3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:



- (a) BIDDER has examined and carefully studied the Bidding Documents and the following Addenda receipt of all which is hereby acknowledged: (List Addenda by Addendum Number and Date)

No. \_\_\_\_\_

Date \_\_\_\_\_

- (b) BIDDER has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance and furnishing of the Work;
- (c) BIDDER is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
- (d) BIDDER has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. BIDDER accepts the determination set forth in paragraph SC-4.2 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which BIDDER is entitled to rely as provided in paragraph 4.2 of the General Conditions. BIDDER acknowledges that such reports and drawings are not Contract Documents and may not be complete for BIDDER's purposes. BIDDER acknowledges that OWNER and Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Bidding Documents with respect to Underground Facilities at or contiguous to the site. BIDDER has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by BIDDER and safety precautions and programs incident thereto. BIDDER does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price and other terms and conditions of the Contract Documents.
- (e) BIDDER is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in the Contract Documents.
- (f) BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents



and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.

- (g) BIDDER has given ENGINEER written notice of all conflicts, errors, ambiguities or discrepancies that BIDDER has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to BIDDER, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.
  - (h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.
4. BIDDER acknowledges that quantities are not guaranteed and final payment will be based on actual quantities determined as provided in the Contract Documents. The Unit prices and/or lump sum amounts listed below include all labor, materials, tools, equipment, transportation, removal, overhead, profit, insurance, taxes, etc., to cover the finished work in place.

Unit prices and/or lump sum amounts are shown in figures with extensions for the estimated quantities and the summation of the extended units to determine a total bid price. In case of error in extension, the Unit Price shall govern rather than the Amount. Where Lump Sum Amounts are bid, the amount for each bid item shall govern rather than the total of any several items.

BIDDER will complete the Work in accordance with the Contract Documents for the following price(s):





**BID SCHEDULE****UPGRADES TO PUMP STATION "B"**

**BASE BID PROPOSAL:** Bidder agrees to perform all of the Work as described in the specifications and on the plans in accordance with the following Bid Schedule:

**BASE BID:** Bidder agrees to perform all of the Work as described in the specifications and on the plans in accordance with the following Bid Schedule:

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Amount</u>
1.	Mobilization	1	LS	\$ _____
2.	Erosion Control	1	LS	\$ _____
3.	Demolition	1	LS	\$ _____
4.	Bypass Pumping – PS "B"	1	LS	\$ _____
5.	Piping and Valves – PS "B"	1	LS	\$ _____
6.	Pumps, Controls and Modifications – PS "B"	1	LS	\$ _____
7.	Modification to and New Building Addition – Ps "B"	1	LS	\$ _____
8.	Electrical – PS "B"	1	LS	\$ _____

**TOTAL AMOUNT BASE BID \$ \_\_\_\_\_**



5. BIDDER agrees that the Work will be substantially complete within the number of calendar days specified in the Supplementary Conditions after the date when the Contract Times commences to run as provided in paragraph 2.3 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.13 of the General Conditions within the number of calendar days specified in the Supplementary Conditions after the date when the Contract Times commences to run.
  - a. BIDDER accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified in the Agreement and/or Contract Documents.
6. The following documents are attached to and made a condition of this Bid. Failure to execute these documents may result in disqualification of BID.
  - a. Required Bid Security in the form of \_\_\_\_\_
  - b. A tabulation of Subcontractors, Suppliers and other persons and organizations required to be identified in this Bid.
  - c. Required BIDDER's Qualification Statement with supporting data.
  - d. Document 00480 - Non-collusion Affidavit of Prime Bidder
  - e. Document 00490 - Certification of NON-SEGREGATED Facilities
7. Communications concerning this Bid shall be addressed to: \_\_\_\_\_  
at the address of BIDDER indicated below.
8. Terms used in this Bid which are defined in the General Conditions or Instructions will have the meanings indicated in the General Conditions or Instructions.
9. BIDDER further agrees that in case of failure on his part to execute the said contract and bond within 10 consecutive calendar days after written notice has been given of the award of the contract, the check and/or bid bond accompany this bid and the monies payable thereon shall be paid into the funds of the owner as liquidated damages for such failure; otherwise, said check or bid bond shall be returned to the undersigned.

Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The bidder agrees that this bid shall be good and may not be withdrawn for a period of NINETY (90) calendar days after the scheduled closing time for receiving bids.

The bidder further proposes and agrees hereby to commence the work with adequate forces and equipment within 15 consecutive calendar days after being notified by the Owner of Engineer to proceed, and to complete the work within the specified time.



**IF BIDDER IS:**

**A Partnership**

By \_\_\_\_\_  
(Firm Name)

\_\_\_\_\_  
(General Partner)

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

Phone No.: \_\_\_\_\_

**A Corporation**

By: \_\_\_\_\_  
(Corporation Name)

\_\_\_\_\_  
(State of Incorporation)

By: \_\_\_\_\_  
(Signature of Person Authorized to Sign)

\_\_\_\_\_  
(Name and Title)

(Corporate Seal)

Attest \_\_\_\_\_  
(Name and Signature of Secretary)

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

Phone No.: \_\_\_\_\_

**A Joint Venture**

By: \_\_\_\_\_  
(Corporation #1 Name)

\_\_\_\_\_  
(State of Incorporation)

By: \_\_\_\_\_  
(Signature of Person Authorized to Sign)

\_\_\_\_\_  
(Name and Title)

(Corporate Seal)

Attest \_\_\_\_\_  
(Name and Signature of Secretary)

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



By: \_\_\_\_\_  
(Corporation #2 Name)

\_\_\_\_\_  
(State of Incorporation)

By: \_\_\_\_\_  
(Signature of Person Authorized to Sign)

\_\_\_\_\_  
(Name and Title)

(Corporate Seal)

Attest \_\_\_\_\_  
(Name and Signature of Secretary)

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

\_\_\_\_\_

Phone Number and Address for receipt of official communications for joint venture:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

**END OF SECTION**





**DOCUMENT 00410  
BID BOND**

**BIDDER** *(Name and Address)*

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

**SURETY** *(Name and Address of Principal Place of Business)*

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

**OWNER** *(Name and Address)*

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

**BID**

BID DUE DATE: \_\_\_\_\_

PROJECT *(Brief Description Including Location)*: \_\_\_\_\_

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

**BOND**

BOND NUMBER: \_\_\_\_\_

DATE *(Not later than Bid Due Date)*: \_\_\_\_\_

PENAL SUM: \_\_\_\_\_

IN WITNESS WHEREOF, Surety and Bidder, intending to be legally bound hereby, subject to the terms printed in this document, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

**BIDDER**

**SURETY**

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

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

By: \_\_\_\_\_  
Signature and Title

By: \_\_\_\_\_  
Signature and Title (Attach Power of Attorney)

Attest: \_\_\_\_\_  
Signature and Title

Attest: \_\_\_\_\_  
Signature and Title

- Note:
1. Above addresses are to be used for giving required notice.
  2. Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

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.



2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents and Contract 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 and Contract 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 and 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 time for issuing notice of award including extensions shall not in the aggregate exceed 120 days from 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 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. Notice 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 the Bond conflicts with any applicable provision of 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.

**END OF SECTION**



**DOCUMENT 00420**  
**STATEMENT OF BIDDER'S QUALIFICATIONS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

Bidder questionnaire

**1.2 BIDDER QUALIFICATIONS**

A. All questions must be answered and the data given must be clear and comprehensive. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information desired. Attach all additional sheets to this statement.

**1.3 QUESTIONS & STATEMENTS**

1. Name of Bidder: \_\_\_\_\_

2. Permanent Main Office address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Federal Identification Number: \_\_\_\_\_

4. When organized: \_\_\_\_\_

5. If a Corporation, where incorporated: \_\_\_\_\_

6. How many years have you been engaged in the contracting business under your present form or trade name? \_\_\_\_\_ year(s)

7. Contracts on hand: (Schedule these, showing amount of each contract and the appropriate anticipated dates of (completion):

<u>Project Name</u>	<u>Amount</u>	<u>Completion Date</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____



8. General description of work performed by your company: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9. Have you ever failed to complete any work awarded to you? Yes\_ No\_\_\_\_  
If so, where and why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10. Have you ever defaulted on a contract? Yes\_\_\_\_\_ No\_\_\_\_\_  
If so, where and why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

11. List the most important projects recently completed by your company, stating the approximate cost for each, and the month and year completed:

<u>Project Name, Owner &amp; Contact</u>	<u>Cost</u>	<u>Completion Date</u>
_____	_____	_____
_____		
_____		
_____	_____	_____
_____		
_____		
_____	_____	_____
_____		
_____		





12. Experience in construction work similar in importance to this project: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

13. Background and experience of the principal members of your organization, including officers, and project manager(s) anticipated for this project:

<u>Name &amp; Address</u>	<u>Background and Experience</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



<u>Name &amp; Address</u>	<u>Background and Experience</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

14. The undersigned hereby authorizes and request any person, firm, or corporation to furnish any information requested by the local public agency in verification of the recitals comprising this Statement of Bidder's Qualifications.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

BIDDER: \_\_\_\_\_

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

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

**PART 2 - PRODUCTS**

Not Used

**PART 3 - EXECUTION**

Not Used

**END OF SECTION**



**DOCUMENT 00430**  
**LIST OF SUBCONTRACTORS AND SUPPLIERS**

The following is a list of the proposed Subcontractors and Material Suppliers that will be used for a portion of the Work required by this Project in accordance with General Conditions Article 6.8. No additions or substitutions to this list can be made without the express written consent of the ENGINEER and OWNER. Failure to list proposed Subcontractors or Suppliers is deemed nonresponsive, and rejection of BID may result.

<u>TYPE OF WORK</u>	<u>SUBCONTRACTOR NAME AND ADDRESS</u>	<u>LICENSE #</u>
Electrical		

<u>TYPE OF MATERIAL</u>	<u>MATERIAL SUPPLIER/ MANUFACTURER</u>

**END OF DOCUMENT**



**DOCUMENT 00480**  
**NONCOLLUSION AFFIDAVIT OF PRIME BIDDER**

State of \_\_\_\_\_ )

County of \_\_\_\_\_ )

\_\_\_\_\_, being first duly sworn, deposes and says that:

- (1) He is \_\_\_\_\_ of \_\_\_\_\_, the Bidder that has submitted the attached Bid:
- (2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid:
- (3) Such Bid is genuine and is not a collusive or sham Bid:
- (4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the OWNER or any person interested in the proposed Contract; and
- (5) The The price or prices quoted in the attached Bid are fair and proper and are not attained by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

Signed: \_\_\_\_\_

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

Subscribed and sworn to before me

this \_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Notary

My commission expires \_\_\_\_\_.

**END OF DOCUMENT**





**DOCUMENT 00490**  
**CERTIFICATION OF NONSEGREGATED FACILITIES**

The Bidder certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control where segregated facilities are maintained. The Bidder certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The Bidder agrees that a breach of this certification will be a violation of the Equal Opportunity clause in any contract resulting from acceptance of this Bid. As used in this certification, the term 'segregated facilities' means any waiting rooms, work areas, restrooms and washrooms, restaurants, and other eating areas, timeclocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. The Bidder agrees that (except where he has obtained identical certification from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000.00 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his files.

Note: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Bidder: \_\_\_\_\_

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

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

Date \_\_\_\_\_, 20\_\_\_\_

Official Address (including Zip Code).

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



**DOCUMENT 00505  
AGREEMENT**

**THIS AGREEMENT** is dated as of the \_\_\_\_ day of \_\_\_\_\_ in the year \_\_\_\_\_ by  
and between   **TOWN OF EDISTO BEACH**   (hereinafter called OWNER) and \_\_\_\_  
\_\_\_\_\_ (hereinafter called CONTRACTOR).

OWNER AND CONTRACTOR, in consideration of the mutual covenants hereinafter set forth,  
agree as follows:

**1. Article 1. Work.**

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is generally as described in Document 00020 - Invitation for Bidders.

**2. Article 2. ENGINEER.**

The Project has been designed by **AMERICAN ENGINEERING CONSULTANTS, INC.** who is hereinafter called ENGINEER and who is 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.

**3. Article 3. CONTRACT TIMES.**

- 3.1. The Work will be substantially completed within the time specified in the Supplementary Conditions after the Notice to Proceed has been issued and completed and ready for final payment in accordance with paragraph 14.13 of the General Conditions within the time specified in the Supplementary Conditions after the Notice to Proceed has been issued.
- 3.2. The Work shall begin within 15 days after the date of the Notice to Proceed. The work shall be done according to the schedule outlined in Section 01000 - Special Provisions.
- 3.3. *Liquidated Damages.* OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties in proving 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) CONTRACTOR shall pay OWNER the amount specified in the Supplementary Conditions for each day that expires after the time specified in paragraph 3.1 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the

time specified in paragraph 3.1 for completion and readiness for final payment or any proper execution thereof granted by the OWNER, CONTRACTOR shall pay the OWNER the amount specified in the Supplementary Conditions for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment.

**4. Article 4. CONTRACT PRICE.**

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents and amount in current U.S. funds equal to the sum of the amounts determined pursuant to paragraph 4.1 below:

4.1. For all Work other than Unit Price Work, a Lump Sum of:

**No Dollars and No Cents**

All specific cash allowances are included in the above price and have been computed in accordance with paragraph 11.8 of the General Conditions:

plus

4.2. for all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work time the estimated quantity of that item as indicated in the CONTRACTOR's Bid.

As provided in paragraph 11.9 of the General Conditions estimated quantities are not guaranteed, and determinations of actual quantities and classification are to be made by the ENGINEER as provided in paragraph 9.10 of the General Conditions. Unit prices have been computed as provided in paragraph 11.9.2 of the General Conditions.

**5. Article 5. PAYMENT PROCEDURES.**

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by the ENGINEER as provided in the General Conditions.

5.1. *Progress Payments: Retainage.* OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Application for Payment as recommended by ENGINEER, on or about the 15th day of each month during construction as provided in paragraphs 5.1.1. and 5.1.2. below. All such payments will be measured by the schedule of values established in paragraph 2.9 of the General Conditions or, in the event there is no schedule of values, as provided in the General Requirements.

5.1.1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with paragraph 14.7 of the General Conditions.

- 5.1.1.1. 90% of Work completed (with the balance being retainage). If Work has been 50 % completed as determined by ENGINEER, and if the character and progress of the Work have been satisfactory to OWNER and ENGINEER, OWNER, on recommendation of ENGINEER, may determine that as long as the character and progress of the Work remain satisfactory to them there will be no additional retainage on account of Work completed, in which case the remaining progress payments prior to Substantial Completion will be in an amount equal to 100 % of the Work completed.
- 5.1.1.2. 90% (with the balance being retainage) of materials, and equipment not incorporated in the Work (but delivered, suitably stored, and accompanied by documentation satisfactory to OWNER as provided in paragraph 14.2 of the General Conditions).
- 5.1.2. Upon Substantial Completion, in an amount sufficient to increase total payments to CONTRACTOR to 98 % ( with the balance being retainage), less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with paragraph 14.7 of the General Conditions.
- 5.2. *Final Payment.* Upon final completion and acceptance of the Work in accordance with paragraph 14.13 of the General Conditions. OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 14.13.

## **6. Article 6 INTEREST.**

All moneys not paid within 30 days of the due date as provided in Article 14 of the General Conditions shall bear interest at the rate of 8% per year compounded monthly. In the event that the payment to CONTRACTOR by OWNER is more than 30 days past due, interest will accrue from the due date.

## **7. Article 7. CONTRACTOR'S REPRESENTATIONS.**

In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

- 7.1. CONTRACTOR has examined and carefully studied the Contract Documents (including the Addenda listed in Paragraph 8) and the other related data identified in the Contract Documents including "technical data."
- 7.2. CONTRACTOR has visited the site and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance or furnishing of the Work.
- 7.3. CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance and furnishing of the Work.
- 7.4. CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as

provided in paragraph 4.2.1 of the General Conditions. CONTRACTOR accepts the determination set forth in paragraph 4.2 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which CONTRACTOR acknowledges that such reports and drawings are not Contract Documents and may not be complete for CONTRACTOR's purposes. CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. CONTRACTOR has obtained and carefully studied ( or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto. CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

- 7.5. CONTRACTOR is aware of the general nature of work performed by OWNER and others at the site that relates to the Work as indicated in the Contract Documents.
- 7.6. CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- 7.7. 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, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

## **8. Article 8 CONTRACT DOCUMENTS.**

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work, consist of the following:

- 8.1. This Agreement.
- 8.2. Performance, Payment, and other Bonds.
- 8.3. Notice to Proceed.
- 8.4. General Conditions.
- 8.5. Supplementary Conditions.

- 8.6. Specifications bearing the title of **Upgrades to Pump Station "B"** and consisting of all divisions and pages as listed in the table of contents thereof.
- 8.7. Drawings consisting of a cover sheet and sheets numbered 1 through 7, inclusive with each sheet bearing the following general title: \_\_\_\_\_.
- 8.8. Addenda numbers \_\_\_ to \_\_\_, inclusive
- 8.9. CONTRACTOR'S Bid
- 8.10. Documentation submitted by CONTRACTOR prior to Notice of Award
- 8.11. The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All Written Amendments and other documents amending, modifying, or supplementing the Contract Documents pursuant to paragraphs 3.5 and 3.6 of the General Conditions.

There are no Contract Documents other than those listed above in this Article 8. The Contract Documents may only be amended, modified, or supplemented as provided in paragraphs 3.5 and 3.6 of the General Conditions.

## **9. Article 9. MISCELLANEOUS.**

- 9.1. Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 9.2. No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and , specifically but without limitation, moneys that may become due and moneys that are 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.
- 9.3. OWNER and CONTRACTOR each binds itself, it partners, successors, assigns, and legal representatives to the other party hereto, it partners, successors, assigns and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.
- 9.4. 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.

**IN WITNESS WHEREOF**, OWNER and CONTRACTOR have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR, and

ENGINEER. All portions of the Contract Documents have been signed, initialed or identified by OWNER and CONTRACTOR or identified by ENGINEER on their behalf. This Agreement will be effective on the date indicated on the first page of this Agreement (which is the Effective Date of the Agreement).

**OWNER: TOWN OF EDISTO BEACH**

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

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

Address for giving notices:

2414 Murray Street  
Edisto Beach, SC 29438

**CONTRACTOR: \_\_\_\_\_**

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

(CORPORATE SEAL)

Attest \_\_\_\_\_

Address for giving notices

\_\_\_\_\_

\_\_\_\_\_

License No.

Agent for service of process: \_\_\_\_\_

\_\_\_\_\_

**END OF AGREEMENT**



# DOCUMENT 00610 PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable

CONTRACTOR *(Name and Address)*:

SURETY *(Name and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

**CONTRACT**

Effective Date of Agreement:  
Amount:  
Description *(Name and Location)*:

**BOND**

Bond Number:  
Date *(Not earlier than Effective Date of Agreement)*:  
Amount:  
Modifications to this Bond Form:

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 (Seal)

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

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

By: \_\_\_\_\_  
Signature (Attach Power of Attorney)

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

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

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

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

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

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

*Note: Provide execution by additional parties, such as joint ventures, if necessary.*

Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

1. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conference as provided in Paragraph 2.1
2. If there is no Owner Default , Surety's obligation under this Bond shall arise after:
  - 2.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 9 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor, and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
  - 2.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 2.1; and
  - 2.3. Owner has agreed to pay the Balance of the Contract Price to:
    - 2.3.1. Surety in accordance with the terms of the Contract; or
    - 2.3.2. Another contractor selected pursuant to Paragraph 3.3 to perform the Contract.
3. When Owner has satisfied the conditions of Paragraph 2, Surety shall promptly, and at Surety's expense, take one of the following actions:
  - 3.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
  - 3.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors, or
  - 3.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 5 in excess of the balance of the Contract Price incurred by Owner resulting from Contractor Default, Or
  - 3.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
    - 3.4.1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after is determined, tender payment therefore to Owner, or
    - 3.4.2. Deny liability in whole or in part and notify Owner citing reasons therefore.
4. If Surety does not proceed as provided in Paragraph 3 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as

provided in Paragraph 3.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner

5. After Owner has terminated Contractor's right complete the Contract, and if Surety elects to act under Paragraph 3.1, 3.2 or 3.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To the limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
  - 5.1. The responsibilities of Contractor for correction of defective work and completion of the Contract ;
  - 5.2. Additional legal, design professional and delay costs resulting from Contractor's default and resulting from the actions of or failure to act of Surety under Paragraph 3; and
  - 5.3. Liquidated damages or, if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.
6. Surety shall not liable to Owner or others for obligations of Contractor that are unrelated to the 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 Owner or its heirs, executors, administrators, or successors.
7. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders and other obligations.
8. 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 Contractor Default or within two years after Contractor ceased working or within two years after 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 period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
9. Notice to Surety, Owner or Contractor shall be mailed or delivered to the address shown on the signature page.
10. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted here from and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
11. Definitions.
  - 11.1. Balance of the Contract Price. The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.

- 11.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
- 11.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise comply with the terms of the Contract.
- 11.4. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or otherwise comply with the other terms thereof.

**FOR INFORMATION ONLY – (Name, Address and Telephone)**

Surety Agency or Broker: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Owner's Representative: \_\_\_\_\_  
(Engineer or other party)  
\_\_\_\_\_  
\_\_\_\_\_

**END OF PERFORMANCE BOND**

**DOCUMENT 00615  
PAYMENT BOND**

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable

CONTRACTOR *(Name and Address)*:

SURETY *(Name and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

**CONTRACT**

Effective Date of Agreement:  
Amount:  
Description *(Name and Location)*:

**BOND**

Bond Number:  
Date *(Not earlier than Effective Date of Agreement)*:  
Amount:  
Modifications to this Bond Form:

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 (Seal)

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

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

By: \_\_\_\_\_  
Signature (Attach Power of Attorney)

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

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

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

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

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

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

*Note: Provide execution by additional parties, such as joint ventures, if necessary.*

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to Owner, this obligation shall be null and void if Contractor:
  - 2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and
  - 2.2. Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.
3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
  - 4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
  - 4.2. Claimants who do not have a direct contract with Contractor:
    - 4.2.1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
    - 4.2.2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
    - 4.2.3. Not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.
5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.
6. Reserved.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.
9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.
11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, 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 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.
12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.
15. Definitions
  - 15.1. Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and 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.

- 15.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
- 15.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract, or to perform and complete or otherwise comply with the other terms thereof.

**FOR INFORMATION ONLY – (Name, Address and Telephone)**

Surety Agency or Broker: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Owner’s Representative: \_\_\_\_\_  
*(Engineer or other party)*  
\_\_\_\_\_  
\_\_\_\_\_

**END OF PAYMENT BOND**



**DOCUMENT 00670  
NOTICE OF AWARD**

To:

Project Description: Upgrades to Pump Station "B"

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for BIDS dated \_\_\_\_\_, and Information for Bidders.

You are hereby notified that your BID, Document 00300 Bid Schedule, has been accepted for your lump sum bid in the total amount of \$\_\_\_\_\_ subject to the following conditions:

1. You are required as specified in Section 00100 – Instruction to bidders and Section 00300 – Bid Form to execute the Agreement within ten (10) calendar days from the date of this Notice to you.
2. You are required as specified in Section 00100 – Instruction to bidders and Section 00300 – Bid Form to furnish the required CONTRACTOR's Performance Bond, Payment Bond, and certificates of insurance within ten (10) calendar days from the date of this Notice to you.
3. Owner has received all necessary financial and pertinent approvals by DHEC or any other institution or government body as required for this project to proceed.

This Notice of Award does not guarantee the execution of the agreement by the Owner.

If you fail to execute said Agreement and to furnish said BONDS within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER's acceptance of your BID as abandoned and as a forfeiture of your BID BOND. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the Owner.

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

\_\_\_\_\_  
Town of Edisto Beach, Owner

BY \_\_\_\_\_

TITLE \_\_\_\_\_

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged

By \_\_\_\_\_

This, the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

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

TITLE \_\_\_\_\_



**DOCUMENT 00680  
NOTICE TO PROCEED**

To:

Project: **Upgrades to Pump Station "B"**

You are notified that the Contract Times under the above contract will commence to run on \_\_\_\_\_. Effective immediately, you are to start performing your obligations under the Contract Documents. In accordance with Article 3 of the Agreement the dates of Substantial Completion and readiness for final payment are \_\_\_\_\_ and \_\_\_\_\_ respectively.

Before you may start Work at the site, paragraph 2.7 of the General Conditions provides that you must deliver to the OWNER (with copies to the ENGINEER and other identified additional insureds) certificates of insurance which you are required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start Work at the site, you must Notify the Engineer and Owner, in writing, at least 10 days before you begin Work.

**OWNER: Town of Edisto Beach**

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

**Title:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**ACCEPTANCE OF AWARD:**

**CONTRACTOR:** \_\_\_\_\_

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

**Title:** \_\_\_\_\_ **Date:** \_\_\_\_\_



# DOCUMENT 00700

## GENERAL CONDITIONS

### 1. ARTICLE 1--DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

- 1.1. *Addenda*--Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the Contract Documents.
- 1.2. *Agreement*--The written contract between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.
- 1.3. *Application for Payment*--The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
- 1.4. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
- 1.5. *Bid*--The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
- 1.6. *Bidding Documents*--The advertisement or invitation to Bid, instructions to bidders, the Bid form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).
- 1.7. *Bidding Requirements*--The advertisement or invitation to Bid, instructions to bidders, and the Bid form.
- 1.8. *Bonds*--Performance and Payment bonds and other instruments of security.
- 1.9. *Change Order*--A document recommended by ENGINEER, 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, issued on or after the Effective Date of the Agreement.
- 1.10. *Contract Documents*--The Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, regulatory required documents, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all

Written Amendments, Change Orders, Work Change Directives, Field Orders and ENGINEER's written interpretations and clarifications issued pursuant to paragraphs 3.5, 3.6.1, and 3.6.3 on or after the Effective Date of the Agreement. Shop Drawing submittals approved pursuant to paragraphs 6.26 and 6.27 and the reports and drawings referred to in paragraphs 4.2.1.1 and 4.2.2.2 are not Contract Documents.

- 1.11. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.9.1 in the case of Unit Price Work).
- 1.12. *Contract Times*--The numbers of days or the dates stated in the Agreement and/or the Supplementary Conditions: (i) to achieve Substantial Completion. and (ii) to complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment in accordance with paragraph 14.13.
- 1.13. *CONTRACTOR*--The person, firm or corporation with whom OWNER has entered into the Agreement.
- 1.14. *Defective*--An adjective which when modifying the word Work refers to Work that is unsatisfactory. faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or 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 14.8 or 14.10).
- 1.15. *Drawings*--The drawings which show the scope. extent and character of the Work to be furnished and performed by CONTRACTOR and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents, Shop drawings are not Drawings as so defined.
- 1.16. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
- 1.17. *ENGINEER*--The person, firm or corporation named as such in the Agreement.
- 1.18. *ENGINEER's Consultant*--A person, firm or corporation having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.
- 1.19. *Field Order*--A written order issued by ENGINEER which orders minor changes in the Work in accordance with paragraph 9.5 but which does not involve a change in the Contract Price or the Contract Times.
- 1.20. *General Requirements*--Sections of Division 1 of the Specifications.

- 1.21. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
- 1.22. *Laws and Regulations; Laws or Regulations*--Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.
- 1.23. *Liens*--Liens, charges, security interests or encumbrances upon real property or personal property.
- 1.24. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
- 1.25. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.
- 1.26. *Notice to Proceed*--A written notice given by OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR's obligations under the Contract Documents.
- 1.27. *OWNER*--The public body or authority, corporation, association, firm or person with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be provided.
- 1.28. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.
- 1.29. *PCBs*--Polychlorinated biphenyls.
- 1.30. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.
- 1.31. *Project*--The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.
- 1.32. *Project Start Date*--The Date specified in the Notice to Proceed by which the Work will commence. The Project Start Date shall be 15 days after the Notice to Proceed has been issued.
- 1.33. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

- 1.34. *Resident Project Representative*-- The authorized representative of ENGINEER who may be assigned to the site or any part thereof.
- 1.35. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
- 1.36. *Shop Drawings*--All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.
- 1.37. *Specifications*--Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.
- 1.38. *Subcontractor*--An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.
- 1.39. *Substantial Completion*--The Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by ENGINEER's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by ENGINEER's written recommendation of final payment in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
- 1.40. *Supplementary Conditions*--The part of the Contract Documents which amends or supplements these General Conditions.
- 1.41. *Supplier*--A manufacturer, fabricator, supplier, distributor, material man 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 any Subcontractor.
- 1.42. *Underground Facilities*--All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.
- 1.43. *Unit Price Work*--Work to be paid for on the basis of unit prices.
- 1.44. *Work*--The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and



equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

- 1.45. *Work Change Directive*--A written directive to CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraph 4.2 or 4.3 or to emergencies under paragraph 6.23. A Work Change Directive will not change the Contract Price or the Contract Times, but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times as provided in paragraph 10.2.
- 1.46. *Written Amendment*--A written amendment of the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

## **2. ARTICLE 2--PRELIMINARY MATTERS**

### ***Delivery of Bonds:***

- 2.1. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish in accordance with paragraph 5.1.

### ***Copies of Documents:***

- 2.2. OWNER shall furnish to CONTRACTOR up to six copies (unless otherwise specified in the Supplementary Conditions) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

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

- 2.3. The Contract Times will commence to run on the fifteenth day after the 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 sixty days after the Notice of Award and upon execution of the agreement. In no event shall the owner exercise the agreement later than sixty (60) days from the Notice of Award without the express written consent of the CONTRACTOR.

### ***Starting the Work:***

- 2.4. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run, but no Work shall be done at the site prior to the date on which the Contract Times commence to run.

***Before Starting Construction:***

- 2.5. Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, 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 knew or reasonably should have known thereof.
- 2.6. Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for review:
  - 2.6.1. 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 Documents;
  - 2.6.2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal;
  - 2.6.3. a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.
- 2.7. Before any Work at the site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with paragraphs 5.4, 5.6 and 5.7.

***Preconstruction Conference:***

- 2.8. Within twenty days after the Contract Times start to run, but before any Work at the site is started, a conference attended by 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 2.6, procedures for handling Shop Drawings and other submittals, processing Applications for Payment and maintaining required records.

***Initially Acceptable Schedules:***

- 2.9. Unless otherwise provided in the Contract Documents, at least ten 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 2.6. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until the schedules are submitted to and acceptable to ENGINEER as provided below. The progress schedule will be acceptable to ENGINEER as providing an orderly progression of the Work to completion within any specified Milestones and the Contract Times, but such acceptance will neither impose on ENGINEER responsibility for the sequencing, scheduling or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor. CONTRACTOR's schedule of Shop Drawing and Sample submissions will be acceptable to ENGINEER as providing a workable arrangement for reviewing and processing the required submittals. CONTRACTOR's schedule of values will be acceptable to ENGINEER as to form and substance.

**3. ARTICLE 3-CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE*****Intent:***

- 3.1. The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.
- 3.2. 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. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and interpretations of the Contract documents shall be issued by ENGINEER as provided in paragraph 9.4.
- 3.3. Reference to Standards and Specifications of Technical Societies; Reporting and Resolving Discrepancies:
- 3.3.1. Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

3.3.2. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any Supplier referred to in paragraph 6.5. CONTRACTOR shall report it to ENGINEER in writing at once, and, CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as authorized by paragraph 6.23) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.5 or 3.6; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

3.3.3. Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement thereto issued by one of the methods indicated in paragraph 3.5 or 3.6, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity or discrepancy between the provisions of the Contract Documents and:

3.3.3.1. the provisions of any such standard, specification, manual, code or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

3.3.3.2. the provisions of any such 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).

No provision of any such standard, specification, manual, code or instruction shall be effective to change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to OWNER, ENGINEER or any of ENGINEER's Consultants, agents or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of paragraph 9.13 or any other provision of the Contract Documents.

3.4. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as approved" or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed 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 shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake

responsibility contrary to the provisions of paragraph 9.13 or any other provision of the Contract Documents.

***Amending and Supplementing Contract Documents:***

3.5. The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

3.5.1. a formal Written Amendment,

3.5.2. a Change Order (pursuant to paragraph 10.4), or

3.5.3. a Work Change Directive (pursuant to paragraph 10.1).

3.6. In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways

3.6.1. a Field Order (pursuant to paragraph 9.5),

3.6.2. ENGINEER's approval of a Shop Drawing or Sample (pursuant to paragraphs 6.26 and 6.27), or

3.6.3. ENGINEER's written interpretation or clarification (pursuant to paragraph 9.4).

***Reuse of Documents:***

3.7. CONTRACTOR, and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER (i) shall not 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 ENGINEER's Consultant, and (ii) shall not reuse any of such Drawings, Specifications, other documents or copies on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaptation by ENGINEER.

**4. ARTICLE 4--AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS**

***Availability of Lands:***

4.1. OWNER shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a correct statement of record legal title and legal description of the lands upon which the Work is to be performed and

OWNER's interest therein as necessary for giving notice of or filing a mechanic's lien against such lands in accordance with applicable Laws and Regulations. OWNER shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which CONTRACTOR will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. If CONTRACTOR and OWNER are unable to agree on entitlement to or the amount or extent of any adjustments in the Contract Price or the Contract Times as a result of any delay in OWNER's furnishing these lands, rights-of-way or easements, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

**4.2. *Subsurface and Physical Conditions:***

- 4.2.1. Reports and Drawings: Reference is made to the Supplementary Conditions for identification of:
  - 4.2.1.1. Subsurface Conditions:: Those reports of explorations and tests of subsurface conditions at or contiguous to the site that have been utilized by ENGINEER in preparing the Contract Documents; and
  - 4.2.1.2. Physical Conditions. Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) that have been utilized by ENGINEER in preparing the Contract Documents.
- 4.2.2. Limited Reliance by CONTRACTOR Authorized; Technical Data: CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any claim against OWNER, ENGINEER or any of ENGINEER's Consultants with respect to:
  - 4.2.2.1. 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
  - 4.2.2.2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings, or
  - 4.2.2.3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such data, interpretations, opinions or information.
- 4.2.3. Notice of Differing Subsurface or Physical Conditions: If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the site that is uncovered or revealed either:

- 4.2.3.1. is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is materially inaccurate, or
- 4.2.3.2. is of such a nature as to require a change in the Contract Documents, or
- 4.2.3.3. differs materially from that shown or indicated in the Contract Documents, or
- 4.2.3.4. 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 conditions affected thereby or performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.23), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such conditions or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

- 4.2.4. ENGINEER's Review: ENGINEER will promptly review the pertinent conditions, determine the necessity of OWNER's obtaining additional exploration or tests with respect thereto and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER's findings and conclusions.
- 4.2.5. Possible Contract Documents Change If ENGINEER concludes that a change in the Contract Documents is required as a result of a condition that meets one or more of the categories in paragraph 4.2.3., a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.
- 4.2.6. Possible Price and Times Adjustments. An equitable adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of such uncovered or revealed condition causes an increase or decrease in CONTRACTOR's cost of, or time required for performance of, the Work; subject, however, to the following:
  - 4.2.6.1. such condition must meet any one or more of the categories described in paragraphs 4.2.3.1 through 4.2.3.4, inclusive;
  - 4.2.6.2. a change in the Contract Documents pursuant to paragraph 4.2.5 will not be an automatic authorization of nor a condition precedent to entitlement to any such adjustment;
  - 4.2.6.3. 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 paragraphs 9.10 and 1 1.9; and
  - 4.2.6.4. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Times if;

- 4.2.6.4.1. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a bid or becoming bound under a negotiated contract; or
- 4.2.6.4.2. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test or study of the site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or
- 4.2.6.4.3. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.2.3.

If OWNER and CONTRACTOR are unable to agree on entitlement to or as to the amount or length of any such equitable adjustment in the Contract Price or Contract Times, a claim may be made therefor as provided in Articles 11 and 12. However, OWNER, ENGINEER and ENGINEER's Consultants shall not 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.

**4.3. *Physical Conditions-Underground Facilities:***

- 4.3.1. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
  - 4.3.1.1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and
  - 4.3.1.2. The cost of all of the following will be included in the Contract Price and CONTRACTOR shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities as provided in paragraph 6.20 and repairing any damage thereto resulting from the Work.
- 4.3.2. Not Shown or Indicated. If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents, 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 6.23), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence of the Underground Facility. If ENGINEER



concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document such consequences. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.20. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or the amount or length of any such adjustment in Contract Price or Contract Times, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12. However, OWNER, ENGINEER and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses or damages incurred or sustained by CONTRACTOR on or in connection with any other project or anticipated project.

**Reference Points:**

- 4.4. 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 shall make no changes or relocation without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point 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 by professionally qualified personnel.
- 4.5. **Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material:**
- 4.5.1. OWNER shall be responsible for any Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. OWNER shall not be responsible for any such materials brought to the site by CONTRACTOR, Subcontractor, Suppliers or anyone else for whom CONTRACTOR is responsible.
- 4.5.2. CONTRACTOR shall immediately: (i) stop all Work in connection with such hazardous condition and in any area affected thereby (except in an emergency as required by paragraph 6.23), and (ii) notify OWNER and ENGINEER (and 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 hazardous condition or take corrective action, if any. CONTRACTOR shall not be required to resume Work in connection with such hazardous condition or in any such affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR special written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (ii) specifying any special conditions under

which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of such Work stoppage or such special conditions under which Work is agreed by CONTRACTOR to be resumed. either party may make a claim therefor as provided in Articles 11 and 12.

- 4.5.3. If after receipt of such special 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 such portion of the Work that is in connection with such hazardous condition or in such affected area to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a claim therefor as provided in Articles II and 12. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.
- 4.5.4. To the fullest extent permitted by Laws and Regulations. OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, employees, agents, other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from such hazardous condition, provided that: (i) 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, and (ii) nothing in this subparagraph 4.5.4 shall obligate OWNER to indemnify any person or entity from and against the consequences of that person's or entity's own negligence.
- 4.5.5. The provisions of paragraphs 4.2 and 4.3 are not intended to apply to Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site.

## **5. ARTICLE 5--BONDS AND INSURANCE**

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

- 5.1. CONTRACTOR shall furnish Performance and Payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury

Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act for the surety at the time of the signing of the bond.

5.2. If the surety on any Bond furnished by CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.1, CONTRACTOR shall within ten days thereafter substitute another Bond and surety, both of which must be acceptable to OWNER.

5.3. ***Licensed Sureties and Insurers; Certificates of Insurance:***

5.3.1. All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.3.2. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain in accordance with paragraph 5.4. OWNER shall deliver to CONTRACTOR, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain in accordance with paragraphs 5.6 and 5.7 hereof.

***CONTRACTOR 's Liability Insurance:***

5.4. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance and furnishing of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

5.4.1. claims under workers' compensation, disability benefits and other similar employee benefit acts;

5.4.2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

5.4.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

- 5.4.4. claims for damages insured by customary personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;
- 5.4.5. 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; and
- 5.4.6. 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 policies of insurance so required by this paragraph 5.4 to be purchased and maintained shall:

- 5.4.7. with respect to insurance required by paragraphs 5.4.3 through 5.4.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants and any other persons or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers and employees of all such additional insureds;
- 5.4.8. include the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
- 5.4.9. include completed operations insurance;
- 5.4.10. include contractual liability insurance covering CONTRACTOR's indemnity obligations under paragraphs 6.12, 6.16 and 6.31 through 6.33;
- 5.4.11. contain a provision or endorsement that the coverage afforded will not be cancelled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.3.2 will so provide);
- 5.4.12. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing defective Work in accordance with paragraph 13.12; and
- 5.4.13. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

***OWNER's Liability Insurance:***

- 5.5. In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.4, 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.

***Property Insurance:***

- 5.6. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall purchase and maintain property insurance upon the Work at the site in the amount of the full 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:
- 5.6.1. include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and any other persons or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
- 5.6.2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework and Work in transit and shall insure against at least the following perils fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils as may be specifically required by the Supplementary Conditions;
- 5.6.3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
- 5.6.4. cover materials and equipment stored at the site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER; and
- 5.6.5. be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR and ENGINEER with thirty days written notice to each other additional insured to whom a certificate of insurance has been issued.
- 5.7. CONTRACTOR shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and any other persons or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

- 5.8. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.6 and 5.7 will contain a provision or endorsement that the coverage afforded will not be cancelled or materially changed or renewal refused until at least thirty days' prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.11.
- 5.9. OWNER shall not be responsible for purchasing and maintaining any property insurance to protect the interests of CONTRACTOR, Subcontractors or others in the Work to the extent of any losses and /or deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount, will be borne by CONTRACTOR, Subcontractor or others suffering any such loss and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.
- 5.10. If OWNER requests in writing that other special insurance be included in the property insurance policies provided under paragraphs 5.6 or 5.7, CONTRACTOR shall, if possible, include such insurance, and the cost thereof will be charged to OWNER by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the site, CONTRACTOR shall in writing advise OWNER whether or not such other insurance has been procured by CONTRACTOR.

**5.11. *Waiver of Rights:***

- 5.11.1. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraphs 5.6 and 5.7 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies 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 of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, employees and agents for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds 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 as trustee or otherwise payable under any policy so issued.
- 5.11.2. In addition, OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers directors, employees and agents of any of them, for:

- 5.11.3. 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 peril, whether or not insured by OWNER; and
- 5.11.4. loss or damage to the completed Project or part thereof caused by, arising out of or resulting from fire or other insured peril covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to paragraph 14.10, after substantial completion pursuant to paragraph 14.8 or after final payment pursuant to paragraph 14.13.

Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in this paragraph 5.11.2 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 any of CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, employees and agents of any of them.

***Receipt and Application of Insurance Proceeds***

- 5.12. Any insured loss under the policies of insurance required by paragraphs 5.6 and 5.7 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.13. OWNER shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.
- 5.13. OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.

***Acceptance of Bonds and Insurance; Option to Replace:***

- 5.14. If either party (OWNER or CONTRACTOR) has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within ten days after receipt of the certificates (or other evidence requested) required by paragraph 2.7. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, 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. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

***Partial Utilization-Property Insurance:***

- 5.15. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion Of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be cancelled or permitted to lapse on account of any such partial use or occupancy.

**6. ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES**

***Supervision and Superintendence:***

- 6.1. 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, but CONTRACTOR shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.
- 6.2. CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications to the superintendent shall be as binding as if given to CONTRACTOR.

***Labor, Materials and Equipment:***

- 6.3. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. 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 indicated in the Contract Documents, all Work at the site shall be performed during regular working hours and CONTRACTOR will not permit overtime work



or the performance of Work on Saturday, Sunday or any legal holiday without OWNER's written consent given after prior written notice to ENGINEER.

- 6.4. Unless otherwise specified in the General Requirements, CONTRACTOR shall furnish and assume full responsibility for all 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 furnishing, performance, testing, start-up and completion of the Work.
- 6.5. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for 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 kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

***Progress Schedule:***

- 6.6. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.9 as it may be adjusted from time to time as provided below:
  - 6.6.1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.9) proposed adjustments in the progress schedule that will not change the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.
  - 6.6.2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of paragraph 12.1. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

***6.7. Substitutes and "Or-Equal" Items:***

- 6.7.1. 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 specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by ENGINEER under the following circumstances:
  - 6.7.1.1. "Or-Equal": If in ENGINEER's sole discretion 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, it may be considered by ENGINEER as an "or-

equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items.

- 6.7.1.2. **Substitute Items:** If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under subparagraph 6.7.1.1, it will be considered a proposed substitute item. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. The procedure for review by the ENGINEER will include the following as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall first make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute.
- 6.7.1.3. **CONTRACTOR's Expense:** All data to be provided by CONTRACTOR in support of any proposed "or-equal" or substitute item will be at CONTRACTOR's expense.
- 6.7.2. **Substitute Construction Methods or Procedures:** If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.7.1.2.

6.7.3. Engineer's Evaluation: ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.7.1.2 and 6.7.2. ENGINEER will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized without ENGINEER's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any "or-equal" or substitute. ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating "or equal items" or substitutes proposed or submitted by CONTRACTOR pursuant to paragraphs 6.7.1 .2 and 6.7.2 and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER accepts an "or equal" or a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed "or equal" and substitute item.

**6.8. *Concerning Subcontractors, Suppliers and Others:***

6.8.1. CONTRACTOR may utilize the services of subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty subcontractors; except that no more than twenty-five percent (25%) of the work included in this contract shall be subcontracted unless a larger percentage of the work is specified in the Supplementary Conditions. CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization (including those acceptable to OWNER and ENGINEER as indicated in paragraph 6.8.2), whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

6.8.2. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials or equipment) to be submitted to OWNER in advance of the specified date prior to the Effective Date of the Agreement for acceptance by OWNER and ENGINEER, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's or ENGINEER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute, the Contract Price will be adjusted by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER or ENGINEER of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

**6.9. Responsibilities for Subcontractors**

- 6.9.1. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.
- 6.9.2. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR. CONTRACTOR shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the ENGINEER through CONTRACTOR.
- 6.10. 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.
- 6.11. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.6 or 5.7, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants and all other additional insureds for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

***Patent Fees and Royalties:***

- 6.12. 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. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants and the officers directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from 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.

***Permits:***

6.13. Unless otherwise provided in the Supplementary Conditions, 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 opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

**6.14. *Laws and Regulations:***

6.14.1. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and 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.

6.14.2. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses and damages caused by, arising out of or resulting therefrom; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.3.2.

***Taxes:***

6.15. 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. If the Owner can and chooses to obtain a rebate on taxes or duties paid by the Contractor on certain Products or items; provide administrative assistance and cooperation to the Owner in this regard.

***Use of Premises:***

6.16. CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by Laws and

Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless OWNER, ENGINEER, ENGINEER'S Consultant and anyone directly or indirectly employed by any of them from and against all claims, costs, losses and damages arising out of or resulting from 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 by or based upon CONTRACTOR's performance of the Work.

- 6.17. During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. CONTRACTOR shall leave the site clean and ready for occupancy by OWNER at Substantial Completion of the Work. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.
- 6.18. 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 property to stresses or pressures that will endanger it.

***Record Documents:***

- 6.19. CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, Samples and Shop Drawings will be delivered to ENGINEER for OWNER.

***Safety and Protection:***

- 6.20. CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
- 6.20.1. all persons on the Work site or who may be affected by the Work;

- 6.20.2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and
- 6.20.3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.20.2 or 6.20.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant 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 person or organization directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work 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 14.13 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

***Safely Representative:***

- 6.21. 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.

***Hazard Communication Programs:***

- 6.22. 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.

***Emergencies:***

- 6.23. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from OWNER or ENGINEER, 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. 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 to document the consequences of such action.

**6.24. Shop Drawings and Samples:**

6.24.1. CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals (see paragraph 2.9). All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The 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 materials and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.26.

6.24.2. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with said accepted schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.26. The numbers of each Sample to be submitted will be as specified in the Specifications.

**6.25. Submittal Procedures:**

6.25.1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

6.25.1.1. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto,

6.25.1.2. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and

6.25.1.3. all information relative to CONTRACTOR's sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.



- 6.25.2. Each submittal will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR'S review and approval of that submittal.
- 6.25.3. At the time of each submission, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.
- 6.26. ENGINEER will review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals accepted by ENGINEER as required by paragraph 2.9. 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. ENGINEER's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means, method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. 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.
- 6.27. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of submission as required by paragraph 6.25.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.25.1.
- 6.28. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submissions accepted by ENGINEER as required by paragraph 2.9, 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.

***Continuing the Work:***

- 6.29. 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, except as permitted by paragraph 15.5 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.30. CONTRACTOR's General Warranty and Guarantee:

6.30.1. CONTRACTOR warrants and guarantees to OWNER, ENGINEER and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

6.30.1.1. abuse, modification or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors or Suppliers; or

6.30.1.2. normal wear and tear under normal usage.

6.30.2. 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:

6.30.2.1. observations by ENGINEER;

6.30.2.2. recommendation of any progress or final payment by ENGINEER;

6.30.2.3. the issuance of a certificate of Substantial Completion or any payment by OWNER to CONTRACTOR under the Contract Documents;

6.30.2.4. use or occupancy of the Work or any part thereof by OWNER;

6.30.2.5. any acceptance by OWNER or any failure to do so;

6.30.2.6. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER pursuant to paragraph 14.13;

6.30.2.7. any inspection, test or approval by others; or

6.30.2.8. any correction of defective Work by OWNER.

***Indemnification:***

6.31. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants and the officers, directors, employees, agents and other consultants 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) caused by, arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage: (i) 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, and (ii) is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity.

- 6.32. In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.31 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 person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.
- 6.33. The indemnification obligations of CONTRACTOR under paragraph 6.31 shall not extend to the liability of ENGINEER and ENGINEER's Consultants, officers, directors, employees or agents caused by the professional negligence, errors or omissions of any of them.

***Survival of Obligations:***

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

**7. ARTICLE 7-OTHER WORK**

***Related Work at Site:***

- 7.1. OWNER may perform other work related to the Project at the site by OWNER's own forces, or let other direct contracts therefor which shall contain General Conditions similar to these, or have other work performed by utility owners. If the fact that such other work is to be performed was not noted in the Contract Documents, then: (i) written notice thereof will be given to CONTRACTOR prior to starting any such other work, and (ii) CONTRACTOR may make a claim therefor as provided in Articles 11 and 12 if CONTRACTOR believes that such performance will involve additional expense to CONTRACTOR or requires additional time and the parties are unable to agree as to the amount or extent thereof.
- 7.2. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the additional work with OWNER's employees) proper and safe access to the site and a reasonable opportunity for

the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

- 7.3. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, 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 so to report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent or nonapparent defects and deficiencies in such other work. Coordination:

***Coordination***

- 7.4. If OWNER contracts with others for the performance of other work on the Project at the site, the following will be set forth in Supplementary Conditions:
- 7.4.1. the person, firm or corporation who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified;
- 7.4.2. the specific matters to be covered by such authority and responsibility will be itemized; and
- 7.4.3. the extent of such authority and responsibilities will be provided.

Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility in respect of such coordination.

**8. ARTICLE 8-OWNER'S RESPONSIBILITIES**

- 8.1. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.
- 8.2. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer against whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

- 8.3. OWNER shall furnish the data required of OWNER under the Contract Documents promptly and shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.4 and 14.13.
- 8.4. OWNER's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions at the site and drawings of physical conditions in existing structures at or contiguous to the site that have been utilized by ENGINEER in preparing the Contract Documents.
- 8.5. OWNER's responsibilities in respect of purchasing and maintaining liability and property insurance are set forth in paragraphs 5.5 through 5.10.
- 8.6. OWNER is obligated to execute Change Orders as indicated in paragraph 10.4.
- 8.7. OWNER's responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.
- 8.8. In connection with OWNER's right to stop Work or suspend Work, see paragraphs 13.10 and 15.1. Paragraph 15.2 deals with OWNER's right to terminate services of CONTRACTOR under certain circumstances.
- 8.9. 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 furnishing or performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.
- 8.10. OWNER'S responsibility in respect of undisclosed Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Materials uncovered or revealed at the site is set forth in paragraph 4.5.
- 8.11. If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract Documents, OWNER's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

## **9. ARTICLE 9--ENGINEER'S STATUS DURING CONSTRUCTION**

### ***OWNER's Representative:***

- 9.1. 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 Documents and shall not be extended without written consent of OWNER and ENGINEER.

**Visits to Site:**

9.2. 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 will endeavor for the benefit of OWNER to determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous on-site inspections 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 on-site observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work. ENGINEER's visits and on-site observations are subject to all the limitations on ENGINEER's authority and responsibility set forth in paragraph 9.13, and particularly, but without limitation, during or as a result of ENGINEER's on-site 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 furnishing or performance of the Work.

**Project Representative:**

9.3. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more continuous observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.13 and in the Supplementary Conditions. 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 person will be as provided in the Supplementary Conditions.

**Clarifications and interpretations:**

9.4. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER or CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree to the amount or extent thereof, if any, OWNER or CONTRACTOR may make a written claim therefor as provided in Article 11 or Article 12.

**Authorized Variations in Work:**

- 9.5. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which 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. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR who shall perform the Work involved promptly. If OWNER or CONTRACTOR believes that a Field Order justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree as to the amount or extent thereof, OWNER or CONTRACTOR may make a written claim therefor as provided in Article II or 12.

***Rejecting Defective Work:***

- 9.6. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective or that ENGINEER believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9. whether or not the Work is fabricated, installed or completed.

***Shop Drawings, Change Orders and Payments:***

- 9.7. In connection with ENGINEER's authority as to Shop Drawings and Samples. see paragraphs 6.24 through 6.28 inclusive.
- 9.8. In connection with ENGINEER's authority as to Change Orders, see Articles 10, 11, and 12.
- 9.9. In connection with ENGINEER's authority as to Applications for Payment. see Article 14.

***Determinations for Unit Prices:***

- 9.10. 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 upon OWNER and CONTRACTOR, unless. within ten days after the date of any such decision. either OWNER or CONTRACTOR delivers to the other and to ENGINEER written notice of intention to appeal from ENGINEER's decision and: (i) an appeal from ENGINEER's decision is taken within the time limits and in accordance with the procedures set forth in Exhibit GC-A, "Dispute Resolution Agreement." entered into between OWNER and CONTRACTOR pursuant to Article 16, or (ii) if no such Dispute Resolution Agreement has been entered into, a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to ENGINEER's decision, unless otherwise agreed in writing by OWNER and CONTRACTOR. Such appeal will not be subject to the procedures of paragraph 9.11.

**Decisions on Disputes:**

- 9.11. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and Claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph. Written notice of each such claim, dispute or other matter will be delivered by the claimant to ENGINEER and the other party to the Agreement promptly (but in no event later than thirty days) after the start of the occurrence or event giving rise thereto, and written supporting data will be submitted to ENGINEER and the other party within sixty days after the start of such occurrence or event unless ENGINEER allows an additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to ENGINEER and the claimant within thirty days after receipt of the claimant's last submittal (unless ENGINEER allows additional time). ENGINEER will render a formal decision in writing within thirty days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. ENGINEER's written decision on such claim, dispute or other matter will be final and binding upon OWNER and CONTRACTOR unless: (i) an appeal from ENGINEER's decision is taken within the time limits and in accordance with the procedures set forth in EXHIBIT GC-A, "Dispute Resolution Agreement," entered into between OWNER and CONTRACTOR pursuant to Article 16, or- (ii) if no such Dispute Resolution Agreement has been entered into, a written notice of intention to appeal from ENGINEER's written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within thirty days after the date of such decision and a formal proceeding is instituted by the appealing party in the Court of Common Pleas for Colleton County, South Carolina to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other- matter in accordance with applicable Laws and Regulations within sixty days of the date of such decision, unless otherwise agreed in writing by OWNER and CONTRACTOR.
- 9.12. When functioning as interpreter and judge under paragraphs 9.10 and 9.11, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to paragraphs 9.10 or 9.11 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.1.5) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either- may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter pursuant to Article I,.
- 9.13. ***Limitations on ENGINEER's Authority and Responsibilities***
- 9.13.1. Neither ENGINEER's authority or responsibility under this Article 9 or under any other provision of the Contract Documents 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 owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them.

- 9.13.2. 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 furnishing or performance of the Work. ENGINEER will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.
- 9.13.3. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.
- 9.13.4. ENGINEER's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and Other documentation required to be delivered by paragraph 14.12 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.
- 9.13.5. The limitations upon authority and responsibility set forth in this paragraph 9.13 shall also apply to ENGINEER's Consultants, Resident Project Representative and assistants.

## **10. ARTICLE 10--CHANGES IN THE WORK**

- 10.1. Without invalidating the Agreement 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 additions, deletions or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- 10.2. If OWNER and CONTRACTOR are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Times that should be allowed as a result of a Work Change Directive, a claim may be made therefor as provided in Article 11 or Article 12.
- 10.3. 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 and supplemented as provided in paragraphs 3.5 and 3.6 except in the case of an emergency as provided in paragraph 6.23 or in the case of uncovering Work as provided in paragraph 13.9. ARTICLE 11--CHANGE OF CONTRACT PRICE

- 10.4. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:
- 10.4.1. changes in the Work which are (i) ordered by OWNER pursuant to paragraph 10.1, (ii) required because of acceptance of defective Work under paragraph 13.13 or correcting defective Work under- paragraph 13.14, or (iii) agreed to by the parties;
  - 10.4.2. changes in the Contract Price or Contract Times 10.4.2. which are agreed to by the parties; and
  - 10.4.3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 9.11; provided that, in lieu of executing any such Change Order; an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.29.
- 10.5. If notice 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) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

## **11. ARTICLE 11--CHANGE OF CONTRACT PRICE**

- 11.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities ties and obligations assigned to or, undertaken by CONTRACTOR shall be at CONTRACTOR's expense without change in the Contract Price.
- 11.2. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any claim for an adjustment in the Contract Price shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the start of the occurrence or event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty days after the start of such occurrence or event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of the claim) and shall be accompanied by claimant's written statement that the adjustment claimed covers all known amounts to which the claimant is entitled as a result of said occurrence or event. All claims for adjustment in the Contract Price shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree on the amount involved. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph 11.2.
- 11.3. The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows:

- 11.3.1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraphs 11.9.1 through 11.9.3, inclusive);
- 11.3.2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 11.6.2);
- 11.3.3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 11.3.2, on the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph

***Cost of the Work:***

- 11.4. The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5:
  - 11.4.1. 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 at the site. 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, vacation and holiday pay applicable thereto. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by OWNER.
  - 11.4.2. 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.
  - 11.4.3. Payments made by CONTRACTOR to the Subcontractors for Work performed or furnished 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 accepted. 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 paragraphs 11.4, 11.5, 11.6 and 11.7. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

- 11.4.4. 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.
- 11.4.5. Supplemental costs including the following:
  - 11.4.5.1. The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.
  - 11.4.5.2. 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.
  - 11.4.5.3. 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, installation, dismantling and removal thereof--all 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.
  - 11.4.5.4. Sales, consumer, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.
  - 11.4.5.5. 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.
  - 11.4.5.6. 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 and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by OWNER in accordance with paragraph 5.9), provided they 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. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.
  - 11.4.5.7. The cost of utilities, fuel and sanitary facilities at the site.

- 11.4.5.8. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.
- 11.4.5.9. Cost of premiums for additional Bonds and insurance required because of changes in the Work.
- 11.5. The term Cost of the Work shall not include any of the following:
  - 11.5.1. Payroll costs and other compensation of CONTRACTOR's officers executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in CONTRACTOR's principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.4.1 or specifically covered by paragraph I 1.4.4--a11 of which are to be considered administrative costs covered by the CONTRACTOR's fee.
  - 11.5.2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.
  - 11.5.3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.
  - 11.5.4. Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by subparagraph 11.4.5.9 above).
  - 11.5.5. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.
- 11.6. The CONTRACTOR's fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:
  - 11.6.1. a mutually acceptable fixed fee; or
  - 11.6.2. 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:
    - 11.6.2.1. for costs incurred under paragraphs 11.4.1 and 11.4.2, the CONTRACTOR's fee shall be fifteen percent;

- 11.6.2.2. for costs incurred under paragraph 11.4.3, the CONTRACTOR's fee shall be five percent;
- 11.6.2.3. 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 11.4.1, 11.4.2, 11.4.3 and 11.6.2 is that the Subcontractor who actually performs or furnishes the Work, at whatever tier, will be paid a fee of fifteen percent of the costs incurred by such Subcontractor under paragraphs 11.4.1 and 11.4.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
- 11.6.2.4. no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5 and 11.5;
- 11.6.2.5. 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
- 11.6.2.6. 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 11.6.2.1 through 11.6.2.5, inclusive.
- 11.7. Whenever the cost of any Work is to be determined pursuant to paragraphs 11.4 and 11.5, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

***Cash Allowances:***

- 11.8. 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 furnished and performed for such sums as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:
  - 11.8.1. the 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
  - 11.8.2. CONTRACTOR's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the 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. 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 .

**11.9. Unit Price Work:**

- 11.9.1. 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 established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. 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. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER in accordance with paragraph 9.10.
- 11.9.2. 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.
- 11.9.3. OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if:
- 11.9.3.1. 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; and
- 11.9.3.2. there is no corresponding adjustment with respect to any other item of Work; and
- 11.9.3.3. if CONTRACTOR believes that CONTRACTOR 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.

**12. ARTICLE 12 - CHANGE OF CONTRACT TIMES**

- 12.1. The Contract Times (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Times (or Milestones) shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Times (or Milestones) shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree. No claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph 12.1.

- 12.2. All time limits stated in the Contract Documents are of the essence of the Agreement.
- 12.3. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a claim is made therefor as provided in paragraph 12.1. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, hoods, epidemics, abnormal weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.
- 12.4. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay. In no event shall OWNER be liable to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (i) delays caused by or within the control of CONTRACTOR. or (ii) delays beyond the control of both parties including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

**13. ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

***Notice of Defects***

- 13.1. Prompt notice of all defective Work of which OWNER or ENGINEER have actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected or accepted as provided in this Article 13.

***Access to Work:***

- 13.2. OWNER, ENGINEER, ENGINEER's Consultants, other representatives and personnel of OWNER, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.

***Tests and Inspections:***

- 13.3. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.



- 13.4. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
  - 13.4.1. for inspections, tests or approvals covered by paragraph 13.5 below;
  - 13.4.2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.9 below shall be paid as provided in said paragraph 13.9; and
  - 13.4.3. as otherwise specifically provided in the Contract Documents.
- 13.5. 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. CONTRACTOR shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for OWNER's and ENGINEER's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work.
- 13.6. 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, it must, if requested by ENGINEER, be uncovered for observation.
- 13.7. Uncovering Work as provided in paragraph 13.6 shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

***Uncovering Work:***

- 13.8. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.
- 13.9. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, 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, furnishing all necessary labor, material and equipment. If it is found that such Work is defective CONTRACTOR shall pay all claims, costs, losses and damages caused by, arising out of or resulting from 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 OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim therefor as provided in Article 11. If, however, such 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 Milestones). or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

***OWNER May Stop the Work:***

13.10. If the Work is defective or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, 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 or any surety or other party.

***Correction or Removal of Defective Work:***

13.11. If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with Work that is not defective. CONTRACTOR shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

***13.12. Correction Period:***

13.12.1. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or 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, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with Work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

13.12.2. 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 or by Written Amendment.

13.12.3. Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this paragraph 13.12, 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.

***Acceptance of Defective Work:***

13.13. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER's recommendation of final payment, also ENGINEER) prefers to accept it, OWNER may do so. 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). If any such acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefor as provided in Article 11. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

***OWNER May Correct Defective Work:***

13.14. 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 in accordance with paragraph 13.11, 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. OWNER may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph OWNER shall proceed expeditiously. In connection with such corrective and 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, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the site 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. All claims, costs, losses and damages incurred or sustained by OWNER in exercising such rights and remedies will be charged against CONTRACTOR and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefor as provided in Article 11. 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. CONTRACTOR

shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies hereunder.

**14. ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION**

***Schedule of values:***

- 14.1. The schedule of values established as provided in paragraph 2.9 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.

***Application for progress Payment:***

- 14.2. At least thirty (30) days before the date established 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 and other arrangements to protect OWNER's interest therein, all of which will be satisfactory to OWNER. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

***CONTRACTOR's Warranty of Title:***

- 14.3. CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

***Review of Applications for Progress Payment:***

- 14.4. ENGINEER will, within five (5) days after receipt of each Application for Payment, 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. The final application for payment must be approved and submitted to the Owner no later than the tenth day of each month in order to be considered for payment in that month. Otherwise, application for payment will be considered in the following month. Twenty (20) days after presentation of the Application for Payment to OWNER with ENGINEER's recommendation, the amount

recommended will (subject to the provisions of paragraph 14.7) become due and when due will be paid by OWNER to CONTRACTOR.

14.5. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's on-site 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:

14.5.1. the Work has progressed to the point indicated,

14.5.2. 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, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.10, and to any other qualifications stated in the recommendation), and

14.5.3. 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.

However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that: (i) exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents or (ii) that 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.

14.6. ENGINEER's recommendation of any payment, including final payment, shall not mean that ENGINEER is 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 furnishing or performance of Work, or for any failure of CONTRACTOR to perform or furnish Work in accordance with the Contract Documents.

14.7. 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 referred to in paragraph 14.5. ENGINEER may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

14.7.1. the Work is defective or completed Work has been damaged requiring correction or replacement,

14.7.2. the Contract Price has been reduced by Written Amendment or Change Order,

14.7.3. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.14, or

14.7.4. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 15.2.1 through 15.2.4 inclusive.

OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

14.7.5. claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work,

14.7.6. 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,

14.7.7. there are other items entitling OWNER to a set-off against the amount recommended, or

14.7.8. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.7.1 through 14.7.3 or paragraphs 15.2.1 through 15.2.4 inclusive; but OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

***Substantial Completion:***

14.8. 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 (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, 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. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within fourteen days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said fourteen days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from

the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

- 14.9. OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

***Partial Utilization:***

- 14.10. Use by OWNER at OWNER's option of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) 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, may be accomplished prior to Substantial Completion of all the Work subject to the following:

- 14.10.1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. 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 paragraphs 14.8 and 14.9 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.

- 14.10.2. No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of paragraph 5.15 in respect of property insurance.

***Final Inspection:***

- 14.11. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will 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 is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

***Final Application for Payment:***

- 14.12. After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered in accordance with the Contract Documents all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance required by paragraph 5.4, certificates of inspection, marked-up record documents (as provided in paragraph 6.19) and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.4.13, (ii) consent of the surety, if any, to final payment, and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Liens arising out of or filed in connection with the Work. In lieu of such releases or waivers of Liens and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and (ii) all payrolls, material and equipment bills and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible 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.

***Final Payment and Acceptance:***

- 14.13. 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 Documents have been fulfilled. ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER's recommendation of payment and present the Application to OWNER for payment. 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 14.15. Otherwise, ENGINEER will return the Application 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. Thirty days after the presentation to OWNER of the Application and accompanying documentation, in appropriate form and substance and with ENGINEER's recommendation and notice of acceptability, the amount recommended by ENGINEER will become due and will be paid by OWNER to CONTRACTOR.



14.14. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

***Waiver of Claims:***

14.15. The making and acceptance of final payment will constitute:

14.15.1. a waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.11, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

14.15.2. a waiver of all claims by CONTRACTOR against OWNER.

**15. ARTICLE 15 - SUSPENSION OF WORK, DELAYS AND TERMINATION**

***Suspension Work and Delays:***

15.1. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an extension of the Contract Times directly attributable to any such suspension if CONTRACTOR makes an approved claim therefore as provided in Article 12.

15.1.1. In the event that CONTRACTOR is delayed in the progress of the work by any act or neglect of OWNER or ENGINEER, or by any separate CONTRACTOR employed by OWNER, CONTRACTOR shall be allowed an extension of the Contract Times directly attributable to any such delay if CONTRACTOR makes an approved claim therefor as provided in Article 12.

15.1.2. OWNER and CONTRACTOR agree that no claim shall be made or allowed for any damages, loss, or expense which may arise out of any delay caused by any of the acts or occurrences referenced in this Article 15, other than claims for the appropriate extension of the Contract Times.

***OWNER May Terminate:***

- 15.2. Upon the occurrence of any one or more of the following events:
  - 15.2.1. if CONTRACTOR persistently fails 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 established under paragraph 2.9 as adjusted from time to time pursuant to paragraph 6.6);
  - 15.2.2. if CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;
  - 15.2.3. Not Used.
  - 15.2.4. Not Used.
  - 15.2.5. IF CONTRACTOR disregards the authority of ENGINEER; or
  - 15.2.6. IF CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

OWNER may, after giving CONTRACTOR (and the surety, if any,) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), 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 finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses and damages sustained by OWNER arising out of or resulting from completing the Work such excess will be paid to CONTRACTOR. If such claims, costs, losses and damages exceed 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, provided that when exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

- 15.3. 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. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.
- 15.4. Upon seven days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to

terminate the Agreement. In such case, CONTRACTOR shall be paid (without duplication of any items):

- 15.4.1. for 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;
- 15.4.2. for 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:
- 15.4.3. for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and
- 15.4.4. for reasonable expenses directly attributable to termination.

CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

***CONTRACTOR May Stop Work or Terminate:***

- 15.5. If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within thirty days after it is submitted or OWNER fails for thirty 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 Agreement and recover from OWNER payment on the same terms as provided in paragraph 15.4. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application for Payment within thirty days after it is submitted, or OWNER has failed for thirty days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may upon seven days' written notice to OWNER and ENGINEER stop the Work until payment of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.5 are not intended to preclude CONTRACTOR from making claim under Articles 11 and 12 for an increase in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping Work as permitted by this paragraph.

**16. ARTICLE 16 - DISPUTE RESOLUTION**

OWNER and CONTRACTOR hereby agree:

- 16.1. All claims, disputes and other matters in question between OWNER and CONTRACTOR arising out of or relating to the Contract Documents or the breach thereof (except for claims which have been waived by the making or acceptance of final payment as provided

by paragraph 14.15) may be decided, at the sole discretion of the OWNER, by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then obtaining, subject to the limitations of this Article 16. This agreement so to arbitrate and any other agreement or consent to arbitrate entered into in accordance herewith as provided in this Article 16 will be specifically enforceable under the prevailing law of any court having jurisdiction. In the event that the OWNER decides not to allow arbitration in accordance with this Article 16, and if no such agreement on an alternate method and procedure for resolving such disputes has been reached, and subject to the provisions of paragraphs 9.10, 9.11, and 9.12, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

- 16.2. No demand for arbitration of any claim, dispute or other matter that is required to be referred to ENGINEER initially for decision in accordance with paragraph 9.1 1 will be made until the earlier of (a) the date on which ENGINEER has rendered a written decision or (b) the thirty-first day after the parties have presented their evidence to ENGINEER if a written decision has not been rendered by ENGINEER before that date. No demand for arbitration of any such claim, dispute or other matter will be made later than thirty days after the date on which ENGINEER has rendered a written decision in respect thereof in accordance with paragraph 9.11; and the failure to demand arbitration within said thirty days' period will result in ENGINEER's decision being final and binding upon OWNER and CONTRACTOR. If ENGINEER renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but will not supersede the arbitration proceedings, except where the decision is accept able to the parties concerned. No demand for arbitration of any written decision of ENGINEER rendered in accordance with paragraph 9.10 will be made later than ten days after the party making such demand has delivered written notice of intention to appeal as provided in paragraph 9.10.
- 16.3. Notice of the demand for arbitration will be filed in writing with the other party to the Agreement and with the American Arbitration Association, and a copy will be sent to ENGINEER for information. The demand for arbitration will be made within the thirty-day or ten- day period specified in paragraph 16.2 as applicable, and in all other cases within a reasonable time after the claim, dispute or other 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 claim, dispute or other matter in question would be barred by the applicable statute of limitations.
- 16.4. Except as provided in paragraph 16.5 below, no arbitration arising out of or relating to the Contract Documents shall include by consolidation, joinder or in any other manner any other person or entity (including ENGINEER, ENGINEER's Consultant and the officers, directors, agents, employees or consultants of any of them) who is not a party to this contract unless:
- 16.4.1. the inclusion of such other person or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration, and

- 16.4.2. such other person 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, and
- 16.4.3. the written consent of the other person or entity sought to be included and of OWNER and CONTRACTOR has been obtained for such inclusion, which consent shall make specific reference to this paragraph; but no such consent shall constitute consent to arbitration of any dispute not specifically described in such consent or to arbitration with any party not specifically identified in such consent.
- 16.5. Notwithstanding paragraph 16.4 if a claim, dispute or other matter in question between OWNER and CONTRACTOR involves the Work of a Subcontractor, either OWNER or CONTRACTOR may join such Subcontractor as a party to the arbitration between OWNER and CONTRACTOR hereunder. CONTRACTOR shall include in all subcontracts required by paragraph 6.11 a specific provision whereby the Subcontractor consents to being joined in an arbitration between OWNER and CONTRACTOR involving the Work of such Subcontractor. Nothing in this paragraph 16.5 nor in the provision of such subcontract consenting to joinder shall create any claim, right or cause of action in favor of Subcontractor and against OWNER, ENGINEER or ENGINEER's Consultants that does not otherwise exist.
- 16.6. The award rendered by the arbitrators 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.
- 16.7. OWNER and CONTRACTOR agree that, at the sole discretion of the OWNER, they shall first submit any and all unsettled claims, counterclaims, disputes and other matters in question between them arising out of or relating to the Contract Documents or the breach thereof ("disputes"), to mediation by The American Arbitration Association under the Construction Industry Mediation Rules of the American Arbitration Association prior to either of them initiating against the other a demand for arbitration pursuant to paragraphs 16.1 through 16.6, unless delay in initiating arbitration would irrevocably prejudice one of the parties. The respective thirty and ten day time limits within which to file a demand for arbitration as provided in paragraphs 16.2 and 16.3 above shall be suspended with respect to a dispute submitted to mediation within those same applicable time limits and shall remain suspended until ten days after the termination of the mediation. The mediator of any dispute submitted to mediation under this Agreement shall not serve as arbitrator of such dispute unless otherwise agreed.

## **17. ARTICLE 17 - MISCELLANEOUS**

### ***Giving Notice:***

- 17.1. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

**17.2. Computation of Times:**

- 17.2.1. When any period of time is referred to in the Contract Documents 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.
- 17.2.2. A calendar day of twenty-four hours measured from midnight to the next midnight will constitute a day.

**Notice of Claim:**

- 17.3. Should OWNER or CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 17.3 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

**Cumulative Remedies:**

- 17.4. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 6.12, 6.16, 6.30, 6.31, 6.32, 13.1, 13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to OWNER and ENGINEER thereunder, 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 Documents, and 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.

**Professional Fees and Court Costs Included:**

- 17.5. Whenever reference is made to "claims, costs, losses and damages," it shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs.

**END OF DOCUMENT**

# DOCUMENT 00815

## SUPPLEMENTARY CONDITIONS

### 1. SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

#### General Conditions - Article 1

The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract have the meanings assigned to them in the General Conditions.

#### General Conditions - Article 1.11

Amend this article to include the following additional definition of Contract Times:

Contract Time to achieve Substantial Completion shall be **150** consecutive calendar days after the Project Start Date as specified in the Notice to Proceed. On site work to start no earlier than December 1<sup>st</sup>.

Contract Time to complete the Work ready for Final Payment in accordance with paragraph 14.13 of the General Conditions shall be **180** consecutive calendar days after the Project Start Date as specified in the Notice to Proceed.

#### General Conditions - Article 2.3

Add this article 2.3.1 concerning Liquidated Damages

- 2.3.1 *Liquidated Damages*:--OWNER and CONTRACTOR recognize that time is of the essence of this Project and that OWNER will suffer loss if the Work is not completed within the times specified in the Supplementary Conditions to Article 1.11 of the General Conditions, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties in proving 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) CONTRACTOR shall pay OWNER **One Thousand Dollars (\$1,000.00)** for each day that expires after the time specified in the Supplementary Conditions to Article 1.11 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the time specified above for completion and readiness for final payment or any proper execution thereof granted by the OWNER, CONTRACTOR shall pay the OWNER **One Thousand Dollars (\$1,000.00)** for each day that expires after the time specified in the Supplementary Conditions to Article 1.11 for completion and readiness for final payment.

**General Conditions - Article 5.4.8**

In accordance with the terms of Article 5.4.8 of the General Conditions, the limits of liability for coverages shall be as follows:

*Owner's and Contractor's Protective Liability Insurance:*

\$500,000.00 per occurrence combined single limit for bodily injury, personal injury, property damage with a \$1,000,000 aggregate liability.

*Commercial General Liability:* Broad Form - ISO Form CG 00 01 11 85 with no exclusions for "X,C & U"

\$500,000.00 per occurrence            \$1,000,000.00 aggregate combined single limit for bodily injury, personal injury, and property damage.

*Automobile Liability:*

\$500,000 combined single limit per accident for bodily injury and property damage.

*Builder's Risk or All Risk Insurance:*

Full Contract Value of the insurable portions of the Work

*Flood Insurance:* CONTRACTOR is required to carry, during the construction period, flood insurance for projects located in designated flood hazard areas in which the Federal Flood Insurance is available.

*Special Hazards:* CONTRACTOR's and Subcontractor's Public Liability and Property Damage Insurance shall at a minimum provide adequate protection against the following special hazards: Use of explosives, excavation, shoring, and electrical hazards.

**2. ADDITIONAL DEFINITIONS:**

1. **Products:** Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
2. **Furnish or Supply:** To supply and deliver, unload, inspect for damage.
3. **Install:** To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and ready for use.
4. **Provide:** To furnish or supply, plus install.
5. **Project Manual:** The Project Manual is the volume usually assembled for the Work which includes the Bid Documents, Contract Documents, and Specifications.

**3. SEVERABILITY:**

1. The terms and conditions of these contract documents are considered to be severable. A determination of the invalidity of any term or condition shall not effect the validity of the remaining terms and conditions of the Subcontract which shall remain in full force and effect.



**4. WAIVERS:**

1. Failure of the Owner or Engineer to exercise any right under the Contract Documents shall not be deemed to be a waiver to exercise such right in the future.
2. Waiver of strict compliance of any provision of the Contract Documents by the Owner or Engineer shall not constitute a waiver of any other provision of said Contract Documents.

**5. INDEMNITY:**

In addition to the indemnity provisions contained within the General Conditions:

To the maximum extent permitted by law, the Contractor shall indemnify and defend the OWNER and the ENGINEER, and their officers, employees, agents, and sub consultants, from all claims and losses, including attorney's fees and litigation costs arising out of property losses or health, safety, personal injury, or death claims by the CONTRACTOR, its subcontractors of any tier, and their employees, agents, or invitees regardless of the fault, breach of Contract, or negligence of the OWNER or the ENGINEER excepting only such claims or losses that have been adjudicated to have been caused solely by the negligence of the OWNER or the ENGINEER and regardless whether or not the CONTRACTOR is or can be named a party in a litigation.

**6. EXCLUSION OF CONTRACTOR CLAIMS**

In performing its obligations, the ENGINEER and its consultants may cause expense for the CONTRACTOR or its subcontractors and equipment or material suppliers. However, those parties and their sureties shall maintain no direct action against the ENGINEER, its officers, employees, agents, and consultants for any claim arising out of, in connection with, or resulting from the engineering services performed or required to be performed.

**7. INSURANCE - GENERAL**

1. Before commencing Work under this Contract, CONTRACTOR shall furnish the OWNER and ENGINEER with certificates of insurance for the insurance as specified in the General Conditions. The certificate shall show the type of insurance, amount, class of operations covered, effective dates, and date of expiration of policies, and contain substantially the following statement:

"The insurance covered by this certificate shall not be canceled or materially altered, except after 30 days' written notice has been received by the OWNER."

2. In case of the breach of any provision of the Articles requiring insurance, the OWNER, at his option may take out and maintain, at the expense of the CONTRACTOR, such insurance as the OWNER may deem proper to obtain similar coverages as specified and may deduct the cost of such insurance from any moneys which may be due or become due the CONTRACTOR under this Contract.

**END OF SUPPLEMENTARY CONDITIONS**



# **SECTION 01025 MEASUREMENT AND PAYMENT**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.
- B. Defect assessment and non-payment for rejected work based on either unit price payment method or a lump sum stipulated price.

### **1.2 AUTHORITY**

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. The Owner will verify measurements and quantities.

### **1.3 UNIT QUANTITIES SPECIFIED**

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. If the Contract is based on a stipulated lump sum price then the Contractor is solely responsible for all quantities of work. If the Contract is based on Unit Prices, then the Quantities and measurements supplied or placed in the Work and verified by the Owner determine payment for unit price items.
- B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.
- C. If the actual Work requires a 25 percent or greater change in quantity than those quantities indicated, the Owner or Contractor may claim for a Contract Price adjustment.

### **1.4 MEASUREMENT OF QUANTITIES**

- A. Measurement Devices:
  - 1. Weigh Scales: Inspected, tested and certified by the applicable South Carolina State Weights and Measures department within the past year.
  - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.

- 3. Metering Devices: Inspected, tested and certified by the authorized technician within the past year.
  
- B. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
  
- C. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
  
- D. Measurement by Area: Measured by square dimension using mean length and width or radius.
  
- E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
  
- F. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

**1.5 PAYMENT**

- A. Payment Includes: Full compensation for all required labor, Products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

**1.6 DEFECT ASSESSMENT**

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
  
- B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct one of the following remedies:
  - 1. The defective Work may remain, but the price will be adjusted to a new sum at the discretion of the Engineer.
  - 2. The defective Work will be partially repaired to the instructions of the Engineer, and the price will be adjusted to a new sum at the discretion of the Engineer.
  
- C. The individual specification sections may modify these options or may identify a specific formula or percentage sum reduction.
  
- D. The authority of the Engineer to assess the defect and identify payment adjustment, is final.

**1.7 NON-PAYMENT FOR REJECTED PRODUCTS**

- A. Payment will not be made for any of the following:
  - 1. Products wasted or disposed of in a manner that is not acceptable.

2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected Products.

**1.8 SCHEDULE OF UNIT PRICES**

Not Used

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**



# **SECTION 01039 COORDINATION AND MEETINGS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Coordination and project conditions.
- B. Preconstruction meeting.
- C. Progress meetings.

### **1.2 RELATED SECTIONS**

Not Used.

### **1.3 COORDINATION AND PROJECT CONDITIONS**

- A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

**1.4 PRECONSTRUCTION MEETING**

- A. Engineer will schedule a meeting after Notice of Award.
- B. Attendance Required: Owner, Engineer, Contractor and major Subcontractors.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
  - 5. Designation of personnel representing the parties in Contract.
  - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders.
  - 7. Scheduling.
  - 8. Procedures for security, house keeping and related matters.
- D. Record minutes and distribute copies within 7 days after meeting to participants, with copies to Engineer, Owner, and Contractor.

**1.5 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.
- B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Engineer, as appropriate to agenda topics for each meeting.
- D. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of Work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems which impede planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of off-site fabrication and delivery schedules.
  - 7. Coordination of projected progress.
  - 8. Maintenance of quality and work standards.
  - 9. Other business relating to Work.
- E. Record minutes and distribute copies within 7 days after meeting to participants, with copies to Engineer, Owner, and Contractor.



**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**



# **SECTION 01060 REGULATORY REQUIREMENTS**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- A. Requirements of regulatory agencies that may or may not have an interest in this contract but all requirements are made a part of this contract. This listing is not intended to be all inclusive of the laws and ordinances that are required in conjunction with this contract.

### **1.2 RELATED SECTIONS**

- A. Document 00501 - Agreement
- B. Document 00701 - General Conditions
- C. Document 00811 - Supplementary Conditions

### **1.3 QUALITY ASSURANCE**

- A. Contractor shall employ competent personnel to comply with all local, state, and federal laws, codes, and ordinances.

### **1.4 REQUIREMENTS**

- A. The construction of the project, including the bidding and issuance of contracts shall conform to the applicable requirements of local, State, and Federal laws, ordinances to the extent that such requirements do not conflict with this contract. If there is a conflict then the most stringent of the two conflicts shall govern.
- B. South Carolina Sales Tax: All applicable South Carolina sales tax shall be paid by the Contractor at no additional cost to the Owner.
- C. Chemicals: All chemicals used during the project construction or furnished for the project operation, whether herbicide, pesticide, disinfectant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with the instructions by the manufacturer and laws.
- D. Safety and Health Regulations: The Contractor shall comply with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).
- E. Inspection by Governing Agencies: The representatives of the South Carolina Department of Health and Environmental Control, Farmers Home Administration, Environmental Protection Agency, U.S. Army Corp of Engineers, Local City and County

Officials in the jurisdiction which the project is located shall have access to the work wherever it is, in preparation of in progress, and the Contractor shall provide proper facilities for such access and inspection and will not make efforts to keep inspectors from gaining access.

**F. Withholding for Non-Residents:**

1. Attention of non-resident contractors is directed to Section 12-9-310, Article 3 of the South Carolina Income Tax Act of 1926, as amended.
2. If a non-resident contractor is the prime contractor on this project, he will be required to post surety bond, or deposit cash or securities with the South Carolina Tax Commission in compliance with the Act. Proof of such coverage shall be filed with the Engineer before the work is started.
3. If the Contractor fails to comply with the requirements of the South Carolina Tax Commission, Two Percent (2%) of each and every payment made to the Contractor shall be retained by the Owner over and above the retainage spelled out elsewhere to satisfy such requirements.

**G. Bypassing of Wastewater:** No wastewater shall be bypassed during construction unless specific approval has been granted by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency. No diversion of flow to the new facility may be made until directed by the Engineer.

**H.** The Owner will provide and maintain competent and adequate observation of Construction as required by 40 CFR 35.2214.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

Not Used

**END OF SECTION**

# **SECTION 01090 REFERENCE STANDARDS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Quality assurance.

### **1.2 RELATED SECTIONS**

- A. General Conditions: Reference standards.

### **1.3 QUALITY ASSURANCE**

- A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date for receiving bids or date of Owner-Contractor Agreement when there are no Bids.
- C. Obtain copies of standards when required by the Contract Documents.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect/Engineer before proceeding.
- F. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Architect/Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

### **1.4 ABBREVIATIONS**

- A. Wherever the following abbreviations are used in the Project Documents, they are to be construed the same as the respective expressions represented unless otherwise explicit definition is given at the use of the abbreviation:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ASTM	American Standards for Testing Materials
AWWA	American Water Works Association
ANSI	American National Standards Institute

AWPA American Wood Preservers Association  
OSHA Occupational Safety and Health Administration  
SCDOT South Carolina Department of Transportation

- B. Wherever the use of South Carolina Department of Transportation Standards is used in these Contract Documents, it is to be construed to mean the South Carolina Department of Transportation's Standard Specifications for Highway Construction (latest edition).

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

Not Used

**END OF SECTION**

# **SECTION 01300 SUBMITTALS AND PROGRESS SCHEDULES**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed Products list.
- D. Shop Drawings.
- E. Product Data.
- F. Samples.
- G. Manufacturer's installation instructions.
- H. Manufacturers' certificates.
- I. Construction photographs.

### **1.2 RELATED SECTIONS**

- A. Section 01400 - Quality Control: Manufacturers' field services and reports.
- B. Section 01700 - Contract Closeout: Contract warranties, bonds, manufacturers' certificates, and closeout submittals.

### **1.3 SUBMITTAL PROCEDURES**

- A. Transmit each submittal with Engineer accepted form.
- B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

- E. Schedule submittals to expedite the Project, and deliver to Engineer at P.O. Box 2299, Cayce, SC, 29171. Coordinate submission of related items.
- F. For each submittal for review, allow 21 days excluding delivery time to and from the contractor.
- G. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- H. Provide space for Contractor and Engineer review stamps.
- I. Revise and resubmit, identify all changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.
- K. Submittals not requested will not be recognized or processed.

**1.4 CONSTRUCTION PROGRESS SCHEDULES**

- A. Submit initial schedule in duplicate within 15 days after date of Owner-Contractor Agreement.
- B. Revise and resubmit as required.
- C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
- D. Schedule Format
  - 1. For contract amounts less than \$500,000.00, submit a computer generated horizontal bar chart with separate line for each section of Work or operation, identifying first work day of each week.
  - 2. For contract amounts greater than \$500,000.00, submit computer generated network analysis diagram using the critical path method, generally as outlined in Associated General Contractors of America (AGC) publication "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry".
- E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration. No activity duration, exclusive of those for submittal review and material fabrication/delivery shall be more than 20 working days or activity must be further subdivided.
- F. Indicate estimated percentage of completion for each item of Work at each submission.
- G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.



- H. Schedules shall be prepared using Primavera Project Planner or equivalent software.
- I. Contractor shall submit 3 paper copies of bar charts and time scaled logic diagrams on 24 inch by 36 inch sheets. Complete project data shall also be submitted on 3 1/2 inch - 1.44 MB - IBM formatted floppy diskettes.
- J. The Owner/Engineer reserves the right to reject Contractor's Application for Payment if the Contractor fails to submit the specified project schedules.

**1.5 PROPOSED PRODUCTS LIST**

- A. Within 15 days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

**1.6 SHOP DRAWINGS**

- A. Submit the number of opaque reproductions which Contractor requires, plus 3 copies which will be retained by Engineer.
- B. Shop Drawings: Submit for review. After review, produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 - CONTRACT CLOSEOUT.
- C. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

**1.7 PRODUCT DATA**

- A. Submit the number of copies which the Contractor requires, plus 3 copies which will be retained by the Engineer.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Indicate Product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. After review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 - CONTRACT CLOSEOUT.

**1.8 SAMPLES**

- A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Engineer selection.
- C. Include identification on each sample, with full Project information.
- D. Submit the number of samples specified in individual specification sections; 2 of which will be retained by Engineer.
- E. Reviewed samples which may be used in the Work are indicated in individual specification sections.

**1.9 MANUFACTURER INSTALLATION INSTRUCTIONS**

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

**1.10 MANUFACTURER CERTIFICATES**

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

**1.11 CONSTRUCTION PHOTOGRAPHS**

- A. Each month submit photographs with Application for Payment.
- B. The Contractor is responsible for taking preconstruction and construction photographs and videos of the site. Video footage shall be provided in a digital format (MPEG or Engineer approved equal) by the Contractor to the Engineer. Video footage shall be cataloged by pump station site. Any photographs submitted shall also be in digital format (JPEG) and cataloged in a similar manner. Pre-construction video footage and photographs of all areas where work will be performed must be submitted prior to beginning any work on the project. Contractor's first application for payment will not be

processed until preconstruction video footage and photographs for the entire project area are submitted to Engineer.

- C. Take a minimum of 12 site photographs of the preconstruction per site and the property adjacent to the perimeter of the construction site.
- D. Take a minimum of 12 site photographs monthly from differing directions indicating the relative progress of the Work, 7 days maximum prior to submitting.
- E. Take a minimum of 12 site photographs of the each postconstruction site and the property adjacent to the perimeter of the construction site. The Contractor shall also provide the Engineer with a video of the entire postconstruction sites and perimeter areas.
- F. Identify photographs with date, time, orientation, and project identification.
- G. The Owner/Engineer reserves the right to reject Contractor's Application for Payment if the Contractor fails to submit the specified project photographs.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

Not Used

**END OF SECTION**



# **SECTION 01400 QUALITY CONTROL**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Quality assurance - control of installation.
- B. Tolerances
- C. References.
- E. Inspecting and testing laboratory services.
- F. Manufacturers' field services and reports.

### **1.2 RELATED SECTIONS**

- A. Section 01090 - Reference Standards.
- B. Section 01300 - Submittals: Submission of manufacturers' instructions and certificates.
- C. Section 01410 - Testing Laboratory Services.
- D. Section 01600 - Material and Equipment: Requirements for material and product quality.
- E. Section 01650 - Starting of Systems.

### **1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.

- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

**1.4 TOLERANCES**

- A. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust Products to appropriate dimensions; position before securing Products in place.

**1.5 REFERENCES**

- A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date for receiving bids, except where a specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

**1.6 INSPECTING AND TESTING LABORATORY SERVICES**

- A. Contractors will employ, and pay for specified services of an independent firm acceptable to the Owner and Engineer to perform inspecting and testing.
- B. The independent firm will perform inspections, tests, and other services specified in individual specification sections and as required by the Engineer or the Owner.
- C. Inspecting, testing, and source quality control may occur on or off the project site. Perform off-site inspecting or testing as required by the Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Engineer indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
  - 1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.

- 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- F. Testing or inspecting does not relieve Contractor to perform Work to contract requirements.
- G. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Engineer. All costs for the original and subsequent testing will be borne by the Contractor.

**1.7 MANUFACTURERS' FIELD SERVICES AND REPORTS**

- A. When specified in individual specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer subject to approval of Engineer.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Submit report in duplicate within 15 days of observation to Engineer for information.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

Not Used

**END OF SECTION**





# **SECTION 01410 TESTING SERVICES**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Selection and payment.
- B. Contractor submittals.
- C. Agency responsibilities.
- D. Agency reports.
- E. Limits on testing authority.
- F. Contractor responsibilities.
- G. Schedule of tests.

### **1.2 RELATED SECTIONS**

- A. Section 00700 - General Conditions: Testing and approvals required by public authorities.
- B. Section 01300 - Submittals: Manufacturer's certificates.
- C. Section 01650 - Starting of Systems : Testing, Adjusting, and Balancing of systems.
- D. Section 01700 - Contract Closeout: Project record documents.

### **1.3 REFERENCES**

- A. ASTM C802 - Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction.
- B. ASTM C1021 - Practice for Laboratories Engaged in the Testing of Building Sealants.
- C. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- D. ASTM C1093 - Practice for Accreditation of Testing Agencies for Unit Masonry.
- E. ASTM D290 - Recommended Practice for Bituminous Mixing Plant Inspection.
- F. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

- G. ASTM D4561 - Practice for Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.
- H. ASTM E329 - Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.
- I. ASTM E543 - Practice for Determining the Qualification of Nondestructive Testing Agencies.
- J. ASTM E548 - Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies.
- K. ASTM E699 - Practice for Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

**1.4 SELECTION AND PAYMENT**

- A. Employment and payment for services of an independent testing agency or laboratory acceptable to the Owner and Engineer to perform specified testing, by Contractor.
- B. Employment of testing agency or laboratory in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

**1.5 QUALITY ASSURANCE**

- A. Comply with all requirements of American Society for Testing and Materials.
- B. Laboratory: Authorized to operate in State in which Project is located.
- C. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

**1.6 CONTRACTOR SUBMITTALS**

- A. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

**1.7 AGENCY RESPONSIBILITIES**

- A. Test samples of mixes submitted by Contractor.

- B. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.
- C. Perform specified sampling and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional tests required by Architect/Engineer.
- G. Attend preconstruction meetings and progress meetings as directed by the Engineer.

**1.8 AGENCY REPORTS**

- A. After each test, promptly submit three (3) copies of report to Architect/Engineer and to Contractor.
- B. Include:
  - 1. Date issued.
  - 2. Project title and number.
  - 3. Name of inspector.
  - 4. Date and time of sampling or inspection.
  - 5. Identification of product and specifications section.
  - 6. Location in the Project.
  - 7. Type of inspection or test.
  - 8. Date of test.
  - 9. Results of tests.
  - 10. Conformance with Contract Documents.
- C. When requested by Architect/Engineer, provide interpretation of test results.

**1.9 LIMITS ON TESTING AUTHORITY**

- A. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Agency or laboratory may not approve or accept any portion of the Work.
- C. Agency or laboratory may not assume any duties of Contractor.
- D. Agency or laboratory has no authority to stop the Work.

**1.10 CONTRACTOR RESPONSIBILITIES**

- A. Deliver to agency or laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
- C. Provide incidental labor and facilities:
  - 1. To provide access to Work to be tested.
  - 2. To obtain and handle samples at the site or at source of Products to be tested.
  - 3. To facilitate tests.
  - 4. To provide storage and curing of test samples.
- D. Notify Architect/Engineer and laboratory 24 hours prior to expected time for operations requiring testing services.
- E. Employ services of an independent qualified testing laboratory and pay for all samples and tests required by specifications.
- F. Contractor shall pay for testing of materials. Testing agency or laboratory used shall be acceptable to the Owner and Engineer.

**1.11 SCHEDULE OF TESTS**

- A. Individual Specification Sections: Tests required and standards for testing.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**

# **SECTION 01500**

## **CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, water, and sanitary facilities.
- B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.
- C. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary offices and buildings.

#### **1.2 RELATED SECTIONS**

- A. Section 01700 - Contract Closeout: Final cleaning.

#### **1.3 TEMPORARY ELECTRICITY**

- A. Cost: By Contractor; provide and pay for power service required from utility source.

#### **1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES**

- A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.
- B. Provide and maintain 1 watt/sq ft. lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes as required.
- D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- E. Maintain lighting and provide routine repairs.
- F. Permanent building lighting may be utilized during construction.

#### **1.5 TEMPORARY HEATING**

- A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

- B. Provide separate metering and reimburse Owner for cost of energy used.
- C. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- D. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in product sections.

**1.6 TEMPORARY COOLING**

- A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.
- B. Provide separate metering and pay for cost of energy used.
- C. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- D. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress and required to protect materials and installed work.

**1.7 TEMPORARY VENTILATION**

- A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

**1.8 TELEPHONE SERVICE**

- A. Provide, maintain, and pay for local telephone service to Engineer's field office at time of project mobilization.

**1.9 FACSIMILE SERVICE**

- A. Provide, maintain, and pay for facsimile service to Engineer's field office at time of project mobilization.

**1.10 TEMPORARY WATER SERVICE**

- A. Provide, maintain and pay for suitable quality water service required. Connect to existing water source for construction operations at time of project mobilization.
- B. Provide separate metering and reimburse Owner for cost of water used.

- C. Provide temporary pipe insulation to prevent freezing.

#### **1.11 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide at time of project mobilization.

#### **1.12 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing buildings.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

#### **1.13 FENCING**

- A. Construction: Contractor's option.

#### **1.14 WATER CONTROL**

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

#### **1.15 EXTERIOR ENCLOSURES**

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

#### **1.16 INTERIOR ENCLOSURES**

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

**1.17 PROTECTION OF INSTALLED WORK**

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

**1.18 SECURITY**

- A. Provide security and facilities to protect Work, and existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

**1.19 ACCESS ROADS**

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.
- B. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Designated existing on-site roads may be used for construction traffic.

**1.20 PARKING**

- A. Provide temporary gravel surface parking areas to accommodate construction personnel.
- B. When site space is not adequate, provide additional off-site parking.
- C. Do not allow vehicle parking on existing pavement.



- D. Designate two parking spaces for the Owner/Engineer.

#### **1.21 PROGRESS CLEANING AND WASTE REMOVAL**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

#### **1.22 PROJECT IDENTIFICATION**

- A. Provide two (2) 8 feet wide x 4 feet high project signs of exterior grade plywood and wood frame construction, painted, with exhibit lettering by professional sign painter or die cut vinyl, self-adhesive letters and self-adhesive corporate logo, to Engineer's design and colors.
- B. List title of Project, names of Owner, Engineer, and Contractor.
- C. Erect on site at location to be established by Engineer and at City Hall at location to be established by Engineer.
- D. No other signs are allowed without Owner permission except those required by law.

#### **1.23 FIELD OFFICES AND SHEDS**

- A. Contractor's Office: Contractor's option.
- B. Locate offices and sheds a minimum distance of 30 feet from existing and new structures.

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

- A. Remove temporary utilities, equipment, facilities, and materials, prior to Final Application for Payment inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

- D. Restore existing and permanent facilities used during construction to original condition.  
Restore permanent facilities used during construction to specified condition.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**

# **SECTION 01600 MATERIAL AND EQUIPMENT**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Products.
- B. Transportation and handling.
- C. Storage and protection.
- D. Equipment Lubricants

### **1.2 RELATED SECTIONS**

- A. Section 01400 - Quality Control: Product quality monitoring.

### **1.3 PRODUCTS**

- A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- B. Provide interchangeable components of the same manufacture for components being replaced.

### **1.4 TRANSPORTATION AND HANDLING**

- A. Transport and handle Products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
- C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

### **1.5 STORAGE AND PROTECTION**

- A. Store and protect Products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive Products in weather tight, climate controlled, enclosures in an environment favorable to Product.

- D. For exterior storage of fabricated Products, place on sloped supports above ground.
- E. Provide off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

**1.6 LUBRICANTS AND EQUIPMENT**

- A. Provide and place manufacturer's recommended lubricants in all equipment as recommended by equipment manufacturer.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**

# **SECTION 01640 PRODUCT HANDLING**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Protect products scheduled for use in the work by means including, but not necessarily limited to, those described in this Section.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplemental Conditions, and other applicable Sections of these specifications.
  - 2. Additional procedures also may be prescribed in other Sections of these specifications.

### **1.2 QUALITY ASSURANCE**

- A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

### **1.3 MANUFACTURER'S RECOMMENDATIONS**

- A. Except as otherwise approved by the Engineer, determine and comply with manufacturer's recommendations on product handling, storage, and protection.

### **1.4 PACKAGING**

- A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
  - 1. Maintain packaged materials with seals unbroken and labels intact until time of use.
  - 2. Promptly remove damaged material and unsuitable items from the job site and promptly replace with material meeting the specified requirements, at no additional cost to the owner.
- B. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory with the Engineer as to manufacturer, grade, quality, and other pertinent information.

**1.5 PROTECTION OF MATERIAL AND WORK**

- A. General:
  - 1. Carefully and properly, protect all materials of every description, both before and after being used in the Work in accordance with manufacturer's recommendations.
  - 2. Provide any enclosing or special protection from weather deemed necessary by the Engineer at no additional cost to the Owner.
- B. Partial payments under the Contract will not relieve the Contractor from responsibility.
  - 1. When materials and work at the site, which have been partially paid for, are not adequately protected by the Contractor, such materials will be protected by the Owner at the Expense of the Contractor and no further partial payment thereon will be made.
- C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

**1.6 STORAGE**

- A. Store all items of equipment, component parts, etc., in accordance with the manufacturer's recommendations or as may otherwise be necessary to prevent damage or deterioration of any sort.
- B. Electrical and control equipment.
  - 1. Store in a dry area protected from dust and humidity.
  - 2. Equipment can be protected by a weatherproof cover if shipped to the site no more than two (2) weeks before installation and energization.

**1.7 REPAIRS AND REPLACEMENTS**

- A. In the event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the Owner.
- B. Additional time required to secure replacements and to make repairs would not be considered by the Engineer to justify extension of the contract time of completion.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**

# **SECTION 01650 STARTING OF SYSTEMS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Starting systems.
- B. Demonstration and instructions.

### **1.2 RELATED SECTIONS**

- A. Section 01400 - Quality Control: Manufacturers field reports.
- B. Section 01700 - Contract Closeout: System operation and maintenance data and extra materials.

### **1.3 STARTING SYSTEMS**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Engineer seven (7) days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01300 that equipment or system has been properly installed and is functioning correctly.

- I. Startup:
  1. Startup of any portion of the entire facility is considered complete when, in the opinion of the Engineer, the facility or designated portion has properly operated for 7 continuous days without significant interruption. The startup period is in addition to specified functional and performance testing and training.
  2. Successful startup of entire facility shall be accomplished prior to determination of substantial completion as defined in the General Conditions.
  3. Significant interruption during startup shall include any of the following events:
    - a. Failure of a system (process, control, building service, etc.) that is not permanently corrected within 4 hours after such failure occurs.
    - b. Failure of a process equipment unit (mechanical, electrical, instrument, etc.) that is not permanently corrected within 6 hours after such failure occurs.
    - c. Failure of an analytical, HVAC, or Building Service, equipment unit that is not permanently corrected with 8 hours after such failure occurs.
  4. "Permanently corrected" shall consist of all of the following:
    - a. Work repaired and replaced to conform with specified requirements.
    - b. Parts and components replaced as recommended by original manufacturer and conforming with reviewed submittals.
    - c. Piping and valves properly installed and connected.
    - d. Wiring properly terminated and enclosed in raceways.
    - e. Accessories, including spare parts and lubricants, furnished as specified.
  5. Occurrence of a significant interruption shall require startup then in progress to be stopped and restarted after permanent corrections are made.

#### 1.4 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel at least two weeks prior to date of Substantial Completion or sooner where applicable.
- B. Demonstrate Project equipment and instruct in a classroom environment. Instruction shall be provided by a qualified manufacturers' representative who is knowledgeable about the Project.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.



- F. The minimum amount of time required for instruction on each item of equipment and system is that specified in individual sections.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**



# **SECTION 01700 CONTRACT CLOSEOUT**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Closeout procedures.
- B. Final cleaning.
- C. Adjusting.
- D. Project record documents.
- E. Operation and maintenance data.
- F. Spare parts and maintenance Products.
- G. Warranties and bonds.
- H. Maintenance service.

### **1.2 RELATED SECTIONS**

- A. Section 01500 - Construction Facilities and Temporary Controls: Progress cleaning.
- B. Section 01650 - Starting of Systems: System start-up, testing, adjusting, and balancing.
- C. Section 01730 – Operation and Maintenance Data.
- D. Section 01740 - Warranties

### **1.3 CLOSEOUT PROCEDURES**

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. Owner will occupy all of the building as specified.

**1.4 FINAL CLEANING**

- A. Execute final cleaning prior to final project assessment.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- D. Clean or Replace filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

**1.5 ADJUSTING**

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

**1.6 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed Shop Drawings, Product Data, and Samples.
  - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
  - 1. Manufacturer's name and product model and number.
  - 2. Product substitutions or alternates utilized.
  - 3. Changes made by Addenda and modifications.

- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured depths of foundations in relation to finish floor datum.
  - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 4. Field changes of dimension and detail.
  - 5. Details not on original Contract drawings.
  
- G. Submit documents to Engineer with claim for final Application for Payment.

**1.7 OPERATION AND MAINTENANCE DATA**

- A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.
  
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
  
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
  
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 24 pound white paper, in three parts as follows:
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.
    - e. Maintenance instructions for equipment and systems.
    - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
  - 3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
    - b. Air and water balance reports.
    - c. Certificates.
    - d. Originals of warranties and bonds.

- E. Submit 1 draft copy of completed volumes 30 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
- F. Submit six sets of revised final volumes, within 15 days after final inspection. In addition, provide three (3) copies of final Operation and Maintenance Manuals in electronic format. Electronic files shall be provided in “.PDF” format for viewing using Adobe Acrobat software. Files shall be saved on recordable compact discs (CD-R) or equivalent.

**1.8 SPARE PARTS AND MAINTENANCE PRODUCTS**

- A. Provide spare parts, maintenance, and extra Products in quantities specified in individual specification sections.
- B. Deliver to and place in location as directed; obtain receipt prior to final payment.

**1.9 WARRANTIES AND BONDS**

- A. Provide warranties in accordance with Section 01740.
- B. Provide duplicate notarized copies.
- C. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.
- D. Provide Table of Contents and assemble in three ring binder with durable plastic cover.
- E. Submit prior to final Application for Payment.
- F. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 15 days after acceptance, listing date of acceptance as start of warranty period.

**1.10 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of components where indicated in specific specification sections for one year from date of Substantial Completion.
- B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**





# **SECTION 01730 OPERATION AND MAINTENANCE DATA**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Format and content of manuals.
- B. Instruction of Owner's personnel.
- C. Schedule of submittals.

### **1.2 RELATED SECTIONS**

- A. Section 01300 - Submittals: Submittals procedures. Shop drawings, product data, and samples.
- B. Section 01400 - Quality Control: Manufacturers' instructions.
- C. Section 01410 - Testing Services: Test and balance reports.
- D. Section 01600 - Material and Equipment: Systems demonstration.
- E. Section 01700 - Contract Closeout: Contract closeout procedures, project record documents.
- F. Section 01740 - Warranties.
- G. Individual Specifications Sections: Specific requirements for operation and maintenance data.

### **1.3 QUALITY ASSURANCE**

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

### **1.4 FORMAT**

- A. Prepare data in the form of an instructional manual.
- B. Binders: Commercial quality, 8-1/2 x 11 inch three D side ring binders with durable plastic covers. When multiple binders are used, correlate data into related consistent groupings.
- C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

- D. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- E. Text: Manufacturer's printed data, or typewritten data.
- F. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- G. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, in three parts as follows:
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions, arranged by system and process flow and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.
    - e. Maintenance instructions for equipment and systems.
    - f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
  - 3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
    - b. Air and water balance reports.
    - c. Certificates.
    - d. Photocopies of warranties.

**1.5 CONTENTS, EACH VOLUME**

- A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
- B. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01400.
- F. Warranties: Bind in copy of each. As specified in Section 01740.

## **1.6 MANUAL FOR MATERIALS AND FINISHES**

- A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured Products.
- B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in individual Product specification sections.
- E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

## **1.7 MANUAL FOR EQUIPMENT AND SYSTEMS**

- A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.
- C. Include color coded wiring diagrams as installed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.
- K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Include test and balancing reports as specified in Section 01400 and 01410.
- O. Additional Requirements: As specified in individual Product specification sections.
- P. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

**1.8 INSTRUCTION OF OWNER PERSONNEL**

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

**1.9 SUBMITTALS**

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit 2 copies of completed volumes 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of all document sets as required prior to final submission.

- D. Submit six sets of revised final volumes in final form within 10 days after final inspection.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**



# SECTION 01740 WARRANTIES

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

- A. Contractor's General Warranty
- B. Preparation and submittal of warranties.
- C. Time and schedule of submittals.

### 1.2 RELATED SECTIONS

- A. Document 00700 - General Conditions
- B. Section 01700 - Contract Closeout
- C. Individual Specifications Sections: Warranties required for specific Products or Work.

### 1.3 GENERAL WARRANTY

- A. CONTRACTOR shall warrant the fitness and soundness of all work performed and all materials and equipment installed under the contract for a period of one (1) year after the date of Substantial Completion as defined in Document 00700, or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents. If any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with Work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.
- B. 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 or by Written Amendment.

- C. Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this Section, 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.
- D. Correction of any defective work shall be performed in accordance with the provisions of Section 00700 – General Conditions of the Contract Documents.

**1.4 FORM OF SUBMITTALS**

- A. Warranty information for specific products or work shall be submitted as follows:
  - 1. Provide warranties executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
  - 2. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.
  - 3. Provide Table of Contents and assemble in three ring binder with durable plastic cover.
  - 4. Submit prior to final Application for Payment.
  - 5. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 15 days after acceptance, listing date of acceptance as start of warranty period.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**



# DOCUMENT 01770

## CERTIFICATE OF SUBSTANTIAL COMPLETION

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

**This Certificate of Substantial Completion applies to:**

All Work under the Contract Documents:
  The following specified portions:

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

The Work to which this Certificate applies has been reviewed by authorized representatives of Owner, Contractor and Engineer, and based upon visual observation found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

A list of items to be furnished, completed or corrected is attached hereto, referred to as a Punch List, and made part of this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:**

Amended Responsibilities
  Not Amended

Owner's Amended Responsibilities:

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Contractor's Amended Responsibilities:

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In addition to the Punch List, the following documents are attached to and made part of this Certificate:

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This Certificate does not represent a warrantee by the Engineer that all Work by Contractor is in accordance with the Contract Documents. This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

\_\_\_\_\_  
Executed by Engineer

\_\_\_\_\_  
Date

\_\_\_\_\_  
Accepted by Contractor

\_\_\_\_\_  
Date

\_\_\_\_\_  
Accepted by Owner

\_\_\_\_\_  
Date



# DOCUMENT 01771

## PUNCH LIST

**(ITEMS TO BE COMPLETED, FURNISHED OR CORRECTED)**

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

**This Punch List applies to:**

- All Work under the Contract Documents:
  The following specified portions of Work:

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Based upon review and observation of the Work by authorized representatives of Owner, Contractor, and Engineer as of the date specified herein, the following list of items shall be completed, furnished or corrected prior to issuance of the final payment for the Work. This list may not be all-inclusive and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. The list may be amended to include additional items at any time after authorized representatives of the Owner or Engineer become aware that the Work completed is not in accordance with the Contract Documents or damage to the Work occurs as a result of work performed by Contractor. This list 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 Work, in a timely manner, in accordance with the Contract Documents.

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

Item No.	Location	Description of Item to be Completed, Furnished, or Corrected

Prepared by:

Reviewed by:

Contractor \_\_\_\_\_

Engineer \_\_\_\_\_



**DOCUMENT 01773  
APPLICATION FOR PAYMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Format for Pay Application. Contractor may submit other Pay Application forms for Engineer's approval similar in format in lieu of what is provided herein.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**



# APPLICATION AND CERTIFICATION FOR PAYMENT

TO OWNER:

PROJECT:

APPLICATION NO:

Distribution to:

<input type="checkbox"/>	ENGINEER
<input type="checkbox"/>	OWNER
<input type="checkbox"/>	CONTRACTOR
<input type="checkbox"/>	
<input type="checkbox"/>	

FROM CONTRACTOR:

PERIOD TO:

Project #  
Contract #

CONTRACTOR PROJECT NO:

CONTRACT DATE:

CONTRACTOR'S APPLICATION FOR PAYMENT  
Application is made for payment, as shown below, in connection with the Contract.  
Billing Worksheets are attached

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

1. ORIGINAL CONTRACT SUM \$ \_\_\_\_\_
2. NET CHANGE BY CHANGE ORDERS \$ \_\_\_\_\_
3. CONTRACT SUM TO DATE (Line 1 + 2) \$ \_\_\_\_\_
4. TOTAL COMPLETED & STORED TO DATE  
Column G of Billing Worksheets) \$ \_\_\_\_\_

5. RETAINAGE:
  - a. \_\_\_\_\_ % of Contract Amount  
(Column D + E of Billing Worksheets) \$ \_\_\_\_\_
  - b. \_\_\_\_\_ % of Stored Material  
(Column F of Billing Worksheets) \$ \_\_\_\_\_
 Total Retainage (Lines 5a + 5b or  
Total in Column I of Billing Worksheets) \$ \_\_\_\_\_

6. TOTAL EARNED LESS RETAINAGE  
(Line 4 Less Line 5 Total) \$ \_\_\_\_\_

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT  
(Line 6 from prior Certificate) \$ \_\_\_\_\_

8. CURRENT PAYMENT DUE \$ \_\_\_\_\_

9. BALANCE TO FINISH, INCLUDING RETAINAGE  
(Line 3 less Line 6) \$ \_\_\_\_\_

CONTRACTOR:

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

State of: \_\_\_\_\_  
County of: \_\_\_\_\_  
Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_ 200\_\_\_\_  
Notary Public \_\_\_\_\_  
My Commission Expires: \_\_\_\_\_

**ENGINEER'S CERTIFICATE FOR PAYMENT**

In accordance with the Contract Documents, based on on-site observations and the data comprising the application, the Engineer certifies to the Owner that to the best of the Engineer's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED .....\$  
(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)  
ENGINEER:

By: \_\_\_\_\_ Date: \_\_\_\_\_  
This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

OWNER

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

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner		
Total approved this Month		
<b>TOTALS</b>		
NET CHANGES by Change Order		









# BILLING WORKSHEET

APPLICATION AND CERTIFICATION FOR PAYMENT

APPLICATION NO:

APPLICATION DATE:

PROJECT:

PERIOD TO:

PERIOD TO:

ENGINEER'S PROJECT NO:

## STORED MATERIALS

A	B	C	D	E	F	G	H	I	J	K
VENDOR	DESCRIPTION	DATE	INVOICE NUMBER	PREVIOUSLY INVOICE MATERIALS	INVOICE MATERIALS THIS PERIOD	INVOICE MATERIALS TO DATE	PREVIOUSLY INSTALLED MATERIALS	INSTALLED MATERIALS THIS PERIOD	INSTALLED MATERIALS TO DATE	CURRENT MATERIALS STORED AMOUNT

	PAGE TOTAL
	GRAND TOTAL (When applicable)



# DOCUMENT 01774 REQUEST FOR INFORMATION

Project:
Owner Project No.
Eng. Project No.
Contract:

Date:
RFI No.:
Drawing Reference:
Specification Reference:

A. INQUIRY BY CONTRACTOR: (Written description of problem - attach sketches as required)

B. REQUESTED RESPONSE TIME/DATE (minimum of 7 days from the date of RFI):

C. SUBMITTED BY:

Contractor:

By:

Signed:

Title:

D. RESPONSE BY ENGINEER:

E. RESPONSE TIME/DATE:

F. SUBMITTED BY:

Engineer:

By:

Signed:

Title:



# DOCUMENT 01775 SUBMITTAL REVIEW COVER SHEET

CONTRACTOR'S STAMP AREA	ENGINEER'S STAMP AREA
SUBMITTAL REVIEW No.: _____	
<i>Project:</i> <b>Updates to Pump Station "A" &amp; "B"</b>	
<i>Contractor:</i> _____	
<i>Owner:</i> <b>Town of Edisto Beach</b>	
<i>Project No.:</i> <b>AEC Project 21-028</b>	
<i>Product:</i> _____	
<i>Manufacturer:</i> _____	
<i>Supplier:</i> _____	
<i>Description:</i> _____	
<i>G.C. Submittal No.:</i> _____	
<i>Revision No.:</i> _____	
<i>Spec. Section:</i> _____	
<i>Drawing No.:</i> _____	
<i>Detail No.:</i> _____	
<i>Date:</i> _____	
<i>By:</i> _____	
Contractor's representative	
Contractor's Certification	
Submittal material has been reviewed for compliance with drawings and specifications. The work shown on this submittal has been coordinated with other submittals affected by this work. All data has been checked by the Contractor and any variations from the specifications or drawings have been noted. The work described on the submittal material is recommended by the Contractor, and the guarantee in the specifications will apply:	
SUBMITTAL COMMENTS (Deviations)	

APPROVED	REJECTED
APPROVED AS NOTED <small>(Resubmission not required)</small>	NOTED <small>(No Action Required)</small>
REVISE AND RESUBMIT	<small>(Check mark indicates action taken)</small>

Review is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for the verification of all dimensions, quantities, and performance requirements, which shall be confirmed and correlated at the job site; for all information that pertains solely to the fabrication processes or techniques of construction; for the coordination of the work of all trades; and for the assurance of consistency and conformance with the Contract Documents.

Approval of drawings or items does not relieve the Contractor of the responsibility for complying with all requirements of the Contract Documents.

AMERICAN ENGINEERING CONSULTANTS, INC.

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





# SECTION 02060 DEMOLITION

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

- A. Demolition of designated structures and removal of materials from site.
- B. Demolition of designated equipment and removal of materials from site.
- C. Related demolition activities.

### 1.2 RELATED SECTIONS

- A. Section 01025 - Measurement and Payment.
- B. Section 01500 - Construction Facilities and Temporary Controls: Barriers, fences and landscape protection. Dust control.
- C. Section 01600 - Material and Equipment.
- D. Section 01700 - Contract Closeout: Project record documents.

### 1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. No direct payment will be made for the work under this Section. All costs for work performed under this Section shall be included in the lump sum price as bid for the project or in other unit costs as applicable.

### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of barricades , fences and temporary work.

### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01700.
- B. Accurately record actual locations of capped utilities and subsurface obstructions.

**1.6 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, and removal and disposal of any asbestos containing materials.
- B. Obtain required permits from authorities.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Do not close or obstruct roadways, sidewalks, or hydrants without permits.
- E. Conform to applicable regulatory procedures when discovering or handling hazardous or contaminated materials.
- F. Notify Owner immediately upon discovery of asbestos materials.

**1.7 SEQUENCING**

- A. Describe demolition removal procedures and schedule.

**1.8 SCHEDULING**

- A. Schedule work under the provisions of Section 01300.
- B. Schedule demolition work to coincide with new construction.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Provide, erect, and maintain temporary barriers and security devices as required.
- B. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
- C. Mark location of utilities.

**3.2 DEMOLITION REQUIREMENTS**

- A. Conduct demolition to minimize interference with adjacent structures.

- B. Cease operations immediately if adjacent structures appear to be in danger. Notify Engineer. Do not resume operations until directed.
- C. Conduct operations with minimum interference to public or private accesses. Maintain protected egress and access at all times.
- D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

**3.3 DEMOLITION**

- A. Disconnect and cap or remove designated utilities within demolition areas.
- B. Remove foundation walls and footings located below grade.
- C. Remove equipment identified to be demolished from site.
- D. Remove materials to be re-installed or retained in a manner to prevent damage. Store and protect in accordance with requirements of Section 01600.
- E. Remove demolished materials from site.
- F. Leave site in clean condition.
- K. Remove temporary work.

**3.4 SCHEDULES**

- A. Coordinate with Engineer regarding items to be removed and retained by Owner; deliver such items to location designated by Engineer.

**END OF SECTION**



# **SECTION 02751 PIPING, VALVES, AND APPURTENANCES**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- A. Plant piping, valves, and appurtenances as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

### **1.2. RELATED SECTIONS**

N/A

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment will be made for work performed under this section. The cost of all work covered by this section shall be included in the lump sum price as bid for the project.

### **1.4 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

### **1.5 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittal.
- B. Product data: Provide a listing of all items to be provided under this Section and include type and location. Also provide:
  - 1. Manufacturer's specifications, shop drawings showing sectional views, dimensions, end connections, operator details and other data needed to demonstrate compliance with the specified requirements.
- C. Certified pipe tests.
  - 1. Pipe materials shall be tested in accordance with the requirements for the applicable material as specified in this Section.
  - 2. Certified records of tests performed by the manufacturer or by an approved commercial laboratory shall be furnished to the Engineer for all shipments of pipe delivered to the job site.

**1.6 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.

**1.7 SUBMITTALS AT PROJECT CLOSEOUT**

- A. Section 01700 - Contract Closeout: 01730 - Operation and Maintenance Data: 01740 - Warranties and Bonds: Procedures for submittals.
- B. Accurately record actual locations of utilities and components which are concealed from view.
- C. Provide Maintenance manuals complying with provisions of Section 01700.

**1.8 PRODUCT HANDLING**

- A. Comply with Section 01600.
- B. Storage of PVC pipe:
  - 1. Store in unit packages as received from manufacturer until just prior to use.
  - 2. Stack units in such manner as to prevent deformation to pipe barrel and bells.
  - 3. If storage period will exceed six weeks, PVC pipe shall be protected from direct sunlight by covering with opaque material
  - 4. Protect pipe from damage resulting from severe impact blows, gouging or cutting by metal surfaces or rocks.

**1.9 JOB CONDITIONS**

- A. Work under this Section may require construction or work in a confined space.
- B. Provide safety equipment as required by applicable codes and ordinances.

**PART 2 - PRODUCTS**

**2.1 PIPE AND FITTINGS**

- A. Service requirements
  - 1. Pipe materials for various services shall be as shown on the drawings. If information is not provided on the drawings, piping 3" and larger shall be ductile iron pipe, including sanitary sewer lines, force mains, and water lines unless otherwise indicated below:

- a. Sanitary sewer, wastewater, scum, return sludge, mixed liquor, secondary effluent and plant effluent: 60" and smaller - Ductile iron; 66" and larger - Class IV reinforced concrete sewer pipe.
  - b. Water lines: 3" and smaller - PVC.
  - c. Air (Low Pressure): Schedule 10, 316 Stainless steel
  - d. Alum: Schedule 80 PVC.
  - e. Chlorine and sulfur dioxide solution: Schedule 80 PVC .
  - f. Drain lines: Ductile iron pipe.
  - g. Pump Seal: Schedule 10, 304 Stainless steel
  - h. Storm drain: Comply with Section 02722.
2. Design pressures: Pressure piping, regardless of type of material, shall be designed for a minimum internal pressure of 150 psi, a surge pressure of 100% of the design pressure, and where applicable, for trench loads as indicated on the drawings.

**B. Lead content:**

- 1. Any pipe, solder, or flux used shall be lead free
  - a. Lead free is defined as less than 0.2 percent lead in solder or flux and less than 8.0 percent lead in pipes and fittings.

**C. Ductile iron pipe (DIP), fittings and accessories:**

- 1. Ductile iron pipe shall be in accordance with ANSI A21.50/AWWA C150 and shall conform to the requirements of ANSI A21.51/ AWWAC151, latest standards. DIP shall be of 60-42-10 ductile iron. All pipe shall be free of cracks or other imperfections. Push-on and restrained joint pipe shall have a minimum rated working pressure of 150 psi. DIP shall also meet the following requirements:
  - a. Buried piping: Provide ductile iron pipe of minimum pressure class as shown in the following table, unless a thicker wall is required for the depth of bury and bedding shown as recommended by the pipe manufacturer.

Pipe Diameter (inches)	Minimum Pressure Class (psi)
4" – 12"	350
14" – 20"	250
24"	200
30" – 64"	150

- b. All flanged pipe or Victaulic grooved pipe shall be Class 53 minimum.
- 2. Fittings: Use 250 psi pressure rated fittings unless otherwise indicated.
  - a. Mechanical fittings or restrained fittings shall conform to ANSI A21.53/AWWA C153 or ANSI A21.10/ AWWA C110. The use of compact fittings is acceptable unless otherwise indicated.
  - b. Flanged fittings shall conform to ANSI A21.10/AWWA C110. The AWWA C110 fitting flanges shall have facing and drilling which match AWWA C115

threaded-on flanges which also match ANSI B16.1 class 125 flanges except where class 250 are specifically noted.

3. Pipe and fitting joints:
  - a. Buried piping: Mechanical or push-on type joints complying with ANSI A21.11/ AWWA C111 as modified by ANSI A21.51/ AWWA C151. Joints shall have rubber gaskets and lubricants complying with ANSI A21.11/ AWWA C111, unless otherwise specified. Provide one of the following restraint methods for restrained joint piping where indicated:
    - i. American Cast Iron Pipe Company:
      - a) Fast Grip,
      - b) Flex Ring, Field Flex-Ring
      - c) Lok-Ring.
      - d) Approved Equal to above by U.S. Pipe, McWane (Clow) Pipe, or Griffin Pipe
  - b. Buried fittings: Mechanical joint complying with ANSI A21.11/ AWWA C111. All mechanical joint fittings shall be restrained using the Megalug restraint mechanism (Series 1100), as manufactured by EBAA Iron Sales, Inc., or approved equal. The use of manufacturer's approved restrained joints shall also be acceptable. The use of concrete thrust blocking for restraint is not allowed.
    - i. The Megalug restraining mechanism shall consist of individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The device shall be capable of full mechanical joint deflection after burial. The joint restraint ring and wedges shall be made of 60-42-10 ductile iron conforming to ASTM A536-84. Dimensions of the gland shall be such that it can be used with a standard mechanical joint bell conforming to ANSI A21.11/ AWWA C111 and ANSI A21.53/ AWWA C153. Megalugs 16" and smaller shall have a rated working pressure of 350 psi, while Megalugs greater than 16" shall have a rated working pressure of 250 psi. Restraint device shall be coated with MEGA-BOND by EBAA Iron, Inc. or approved equal.
  - c. Exposed piping and fittings: Use flanged joints complying with ANSI A21.15/ AWWA C115.
    - i. Full face 1/8" thick, rubber ring, factory cut, gaskets shall be used.
    - ii. Bolts and nuts shall conform to ANSI A21.11/ AWWA C111.
  - d. Air piping and fittings: Use EPDM (Ethylene Propylene Diene Monomer) gaskets unless otherwise specified
4. Coatings (Pipe and Fittings):
  - a. Buried piping and fittings shall be furnished with bituminous exterior coating.
  - b. Exposed piping and fittings shall be furnished with an exterior shop coating of red primer in order to facilitate painting.
5. Linings (Pipe and Fittings):
  - a. All pipe and fittings to be provided with standard thickness cement lining complying with ANSI A21.4/ AWWA C104 unless otherwise noted.
  - b. Sewer Lines & Sewer Force Main: All ductile iron pipe and fittings shall be lined with Protecto 401 Ceramic Epoxy lining as specified herein.



- c. Air Lines: Provide 0.8 dry mils of coal tar epoxy lining on ductile iron air pipe and fittings.
6. Protecto 401 Ceramic Epoxy lining: All ductile iron sewer lines, sewer forcemain and associated fittings shall be lined with Protecto 401 Ceramic Epoxy lining. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment, and shall meet the following requirements:
  - a. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.
  - b. The following requirements from coupon testing:
    - i. undercutting results after a one year period when subjected to ASTM B-117 Salt Spray.
    - ii. Less than 0.5 mm undercutting after 30 days when subjected to ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F.
    - iii. Immersion Testing rated using ASTM D-714-87 no effect after one year when tested with 20% Sulfuric Acid, 25% Sodium Hydroxide, 160°F Distilled water and 120°F Tap water.
7. Protecto 401 Ceramic Epoxy lining shall be subjected to the application procedure:
  - a. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of pipe and fittings.
  - b. Prior to abrasive blasting, the entire area to receive the protective compound shall be cleaned of oil, grease, etc. using a solvent according to the guidelines outlined in DIPRA-1 Solvent Cleaning. Following solvent cleaning, all areas to receive protective coating shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media so that all rust, loose oxides, etc. are removed from the surface.
  - c. After the surface preparation and within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry thickness of Protecto 401. No lining shall take place when the substance or ambient temperature is below 40oF. The surface also must be dry and dust free. If flange pipe or fittings are included in the project the lining shall not be used on the face of the flange.
  - d. Coating of Bell Sockets and Spigot Ends - Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum Protecto Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.
  - e. The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. No material shall be used for lining which is not indefinitely re-coatable with itself without roughening of the surface.
  - f. Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.
  - g. Lining Inspection:

- i. All ductile iron pipe and fittings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness rating.
- ii. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500 volt test. Any defects found shall be repaired prior to shipment.
- iii. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.
- h. Lining Certification - The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

D. Reinforced concrete pipe (RCP):

1. Provide pipes complying with ASTM C76 for Class IV, Wall B.
2. Furnish Pipe with joints designed for flexible watertight gaskets.
3. Provide O-ring rubber gaskets complying with ASTM C443; or
4. Preformed plastic gaskets complying with AASHTO Designation M-198 for Type B, Flexible Plastic Gasket.

E. Plastic pipe and fittings (PVC):

1. Provide pipe complying with ASTM 1785 for PVC 1120, Schedule 80 unless otherwise indicated and NSF approved.
  - a. Provide socketed end connections on underground piping.
  - b. Provide solvent weld joints on exposed piping.
2. Fittings:
  - a. Use PVC fittings, same schedule as Pipe and with joints conforming to pipe joints.

F. Copper pipe and fittings (CP):

1. Exposed: Provide minimum Type "NM", hard drawn, with wrought copper fittings, soldered.
2. Buried: Provide minimum Type "L", hard drawn, with wrought copper fittings, soldered.
3. In conduit: Provide minimum Type "K", soft copper with brass flared fittings.

G. Stainless steel pipe and fittings (SSP):

1. Air lines:
  - a. Use Type 316, Schedule 10 pipe for air lines.
2. Hydraulic lines:
  - a. Use Type 304. Provide thickness for pressures required.
3. Pump seal water:
  - a. Use Type 304, Schedule 40 (1" and larger).
  - b. Use Type 304 pressure tubing (3/4" and smaller).

- H. Galvanized steel piping and fittings:
1. Conform to Federal Specification WW-P-406C (1) for Weight A, Class 2, hot-dip, zinc coated pipe.
  2. Fittings:
    - a. Provide 150 lbs. screwed fittings conforming to Federal Specifications WW-P-52ID, Type II.
    - b. Ends shall be threaded and coupling at one end.
    - c. Joint couplings shall be hot-dip, zinc-coated.
- I. Fiberglass reinforced plastic pipe and fittings (FRP):
1. Provide where indicated on the drawings FRP pipe and fittings.
  2. Provide FRP pipe and fittings manufactured by the centrifugal casting process, In accordance with ASTM D-2997, RTRP, Type II, Grade 1, Class C, with a minimum 50 mil pure resin corrosion barrier and constant smooth IPS O.D.
  3. Pipe, fittings and adhesive shall be made using the same epoxy resin and shall be suitable for a minimum pressure of 225 psi at 225 degrees F using adhesive socket joints made in accordance with manufacturer's recommendations.
  4. Field tapering or machining of pipe ends for joining with adhesive socket joints shall not be allowed.
  5. Pipe and fittings shall be Centricast II as manufactured by Fibercast Company of Sand Springs, OK or Engineer's approved equal.

## 2.2 METALLIC DETECTION TAPE

- A. Provide 2" wide metallic detection tape on all buried PVC piping.
1. Provide 5.0 mil overall thickness with no less than a 50 gauge solid aluminum foil core.
  2. Foil to be visible from both sides.
  3. No inks or printing extended to the edges of the tape.
  4. Encase printing to avoid ink rub-off.
  5. Tensile strength - 28 lbs/inch.
  6. Use heat set mylar inks.
- B. Locate 12" below ground surface in pipe trench.
- C. Color to be as indicated below:
1. Chemical lines - High visibility safety yellow.
  2. Potable water lines - Safety precaution blue.
  3. Sanitary sewer - Safety green.
  4. Force mains – Safety green.
- D. Wording on tape shall indicate pipe contents.

## 2.3 VALVES - GENERAL

- A. Valves and appurtenances shall be the type, size and class shown on the plans, unless otherwise noted, underground valves shall have standard mechanical joint ends and exposed valves shall have flanged ends. Flanges shall be Class 125 except where class 250 is specifically noted. Valves shall be furnished with operating devices as specified or shown. Direction of opening for all valves shall be identical to that of existing valves in the system; otherwise all valves shall open left (counter-clockwise). Valves shall be at least the same class as the pipe on which they are used. All exposed valves shall be shop primed. Valves shall be marked with the name of the manufacturer, year of manufacture, maximum working pressure, direction of flow, and size, as applicable. Insofar as possible, all valves of the same type shall be by the same manufacturer.

## 2.4 GATE VALVES

- A. General:
1. Stem extensions shall be provided to bring the valve operating nut to within at least 18" of finished grade, if required.
  2. Valves shall be provided with end connections matching the piping in which they are to be installed.
  3. Valves up to 12" shall be rated at a minimum working pressure of 200 psi.
  4. Valves larger than 12" shall be rated at a minimum working pressure of 150 psi.
  5. The opening direction of all valves shall be identical to that of existing valves in the system, otherwise, valves shall open by turning counter-clockwise.
- B. Gate Valves – 1-1/2" or less
1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, with control rod, post indicator, extension box and valve key. Provide handwheel operator for exposed locations.
- C. Gate Valves - 2 Inches And Over
1. AWWA C509, Iron body, bronze trim, non-rising stem with operator, single wedge, resilient seat, mechanical joint ends (or ends to match piping in which valve is installed). All interior and external ferrous surfaces including the interior of the gate, shall be coated with a protective coating conforming to AWWA C550, latest revision, control rod, extension box, and protective concrete collar. Valves shall be rated at 200 psi working pressure. Buried valves shall have a square nut operator and valve box with extension stems if necessary to extend the valve operator to within at least 18 inches of the top of the ground, unless otherwise noted. Non-buried valves shall be supplied with flanged ends and a handwheel.

## 2.5 PLUG VALVES

### A. General:

1. Provide non-lubricated, eccentric type plug valves having resilient faced plugs, complying with AWWA Standard C504 and other requirements specified herein.
2. Furnish screwed, flanged or mechanical joint end connections as indicated on the Drawings. Screwed ends shall be to the NPT standard. Flanged valves shall be faced and drilled to ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111.
3. Provide valves of bolted bonnet design:
  - a. Valves 4" and larger to be designed to allow repacking without removing the bonnet and the packing shall be adjustable.
  - b. Packing to be replaceable with the valve under pressure with valve open or closed with pressure on either side of the plug.
4. Provide valves capable of drip-tight shutoff up to full rating with pressure in either direction. Pressure ratings shall be 175 psi for 4" through 12", 150 psi for 14" through 36", and 125 psi for 42" and larger.
5. Valve bodies shall be cast iron complying with ASTM A126, Class B and AWWA Standard C-517.
6. All exposed nuts, bolts, springs, etc. shall be stainless steel on all valves.
7. The valve shall be manufactured by DeZURIK or equal.

### B. Port Areas

1. Four inch through twenty inch valves, not less than 80% of full pipe area.
2. Twenty-four inch and larger, not less than 70% of full pipe area.
  - a. Port to be smoothly shaped with an unobstructed waterway when open.

### C. Seats

1. Provide corrosion resistant seats complying with AWWA Standard C517.
2. Three inch and larger valves to have a 1/8" thick welded-in overlay of not less than 90% nickel content on all surfaces contacting the plug face.
  - a. Seat to be raised from the valve body and machined to a smooth finish.

### D. Bearings

1. Provide valves through twenty inch size with permanently lubricated, 316 stainless steel bearings in the upper and lower plug stem journals.
2. Provide twenty-four inch and larger valves with bronze bearings and stainless steel sleeves in the upper and lower plug stem journals.
3. Bearings to comply with AWWA Standard C517.
4. Lower bearing housing to be raised from the body to reduce the possibility of grit and sand entering the bearing housing.

## E Flanged End Connections

1. Provide, where indicated, valves with flanged ends, faced and drilled to ANSI 125/150 pound standard.
2. Flanged valves through 12" to have face-to-face dimensions of AWWA standard gate valves.

## F. Resilient Plug Facing

1. Provide neoprene plug facings vulcanized to the plug and suitable for use with domestic wastewater.
2. Plug to be one piece.
3. Do not use plugs with cast inlays.

## G. Buried Service Valves

1. Provide seals on all shafts and gaskets on valve covers to prevent entry of water and dirt.

## H. Actuators

1. Manual valves to be provided with lever or gear actuators and tee wrenches, extension stems, floor stands, chainwheels, etc. as indicated on the Drawings.
  - a. Provide a lever for each lever operated valve.
  - b. Provide one tee wrench for every five valves utilizing the tee wrench operation.
  - c. Handwheel shall be a minimum 12" diameter.
2. Valves furnished for installation in a valve box to be provided with a 2" square operating nut and extension within 18" of the top of the valve box.
3. Provide 6" and larger valves with gear actuators.
  - a. Provide gear to fit on hexagonal valve shaft to allow operation without the use of roll pins.
  - b. Handwheel and chainwheel components between the input and the stop-limiting devices to be designed to withstand, without damage, a pull of 200 Pounds as required by the American Water Works Association (AWWA) Standard C517.
  - c. Pulley and chain for chainwheel actuators to be hot-dipped galvanized unless otherwise noted on the plans.
  - d. Gear actuators, normal service:
    - i. Enclose all gearing in a semi-steel housing suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt or water into the actuator.
    - ii. Support actuator shaft and quadrant on permanently lubricated bronze bearings:
    - iii. Provide valve position indicator and an adjustable stop to set closing torque.
    - iv. All exposed nuts, bolts and washers to be stainless steel.
    - v. Provide air gap between the actuator and the valve body to prevent leakage from the valve into the actuator.

- e. Gear actuators, buried service:
  - i. Provide neoprene seals on all shafts and gaskets on actuator covers to prevent entry of water and dirt.
  - ii. Mounting brackets to be totally enclosed with gasket seals.
  - iii. Support actuator shaft and quadrant on permanently lubricated bronze bearings.
  - iv. All exposed nuts, bolts and washers to be stainless steel.
- 4. Power actuators: Where indicated, furnish power actuators.
  - a. Electric motor actuators:
    - i. Comply with Section 11205.
  - b. The plug valve manufacturer shall secure and install power actuators on the valves and shall accept total responsibility for its installation and satisfactory operation.

## 2.6 CHECK VALVES

- A. Cushioned swing check valves, 3" and larger:
  - 1. Valves 3" diameter and larger shall have cast iron body with bronze seating ring and stainless steel shaft for attachment of lever and spring with non-adjustable air cushioned shock chamber.
  - 2. The cushioned chamber shall be mounted to the side of the valve body with piston operating in the chamber which will prevent valve closing without any hammering action.
  - 3. Shock absorption shall be by air with adjustable closing speed.
  - 4. The valve shall be specifically designed for application in the Fluid being transferred. The valve shall be as manufactured by G.A. Industries, Inc. or Engineer approved equal.
- B. Swing check valves, smaller than 3":
  - 1. Valves smaller than 3 inch diameter shall be all brass.
  - 2. End connections shall be required for the piping in which they are installed.
  - 3. Valves shall have swing removable disc.
  - 4. Valves shall be Class 250 working pressure type.
- C. Ball check valves, smaller than 3":
  - 1. Furnish bronze bodied valve.
  - 2. Valve ends to be female NPT.
  - 3. Provide threaded bronze cap.
  - 4. Provide hollow stainless steel ball with a specific gravity greater than 1.0.
  - 5. Provide rubber seat.
  - 6. Maximum working pressure - 150 psi.
  - 7. Maximum working temperature - 185 degrees F.
  - 8. Provide Flygt Model HDL Type 2002, ABS Type 50 or equal.

- D. Ball check valves, 3" and larger:
1. Furnish Cast Iron A126 CL.B bodied valve.
  2. Valve ends to be flanged.
  3. Provide threaded bronze cap.
  4. Provide a hollow metal ball covered with vulcanized Buna-N rubber.
  5. Maximum working pressure - 150 psi.
  6. Maximum working temperature - 150 degrees F.
  7. Provide GA Industries Fig. #240-D or equal.

## 2.7 SURGE RELIEF VALVES

- A. Main valve body shall be long radius elbow pattern of cast iron conforming to ASTM A126 Class B, with integral flanges, faced and drilled per ANSI B16.1 Class 125. The valve body shall be inherently self-cleaning and have a net flow area through the valve no less than the area of its nominal pipe size. The body shall have a removable bronze seat.
- B. The valve disc shall be cast iron or steel with a renewable, resilient seat ring of rubber or other suitable material and retained by a bronze or stainless steel follower ring and stainless steel screws. The valve stem shall be stainless steel bushing retained in the valve cover. The valve stem shall be sealed where it passes through the body by dual seals separated by a lantern ring with external leak detection port.
- C. Sizes through 8" shall have dual compression springs; larger valves shall have a single compression spring. Springs shall be encased in steel cylinders; exposed springs or tension springs are not acceptable. An integral hydraulic system shall permit quick opening and adjustable, slow closing without the need of pre-charged cylinders. The valve shall be fully capable of operating in any position.
- D. The valve shall be factory tested and set to open at a pre-determined pressure. Springs shall permit field adjustment from near zero to 10 percent above factory setting.
- E. The surge relief valve shall quickly open when the system pressure exceeds its setting, remain open as long as the pressure exceeds this setting, and slowly close drop tight when the pressure subsides below the spring setting.
- F. The valve shall be GA Industries, Inc. Figure 624-D or approved equal.
- G. Install valve in accordance with manufacturer's written instructions and approved submittals.
- H. Manufacturer's authorized representative shall be present at the jobsite for assistance during equipment start-up and to train owner personnel in the operation, maintenance and troubleshooting of the equipment provided.

## 2.8 MUD VALVES

- A. Provide Flanged frame, faces and drilled, 125# standard, iron bodied, rising stem, with bronzed bushed removable yoke.



1. Provide bronze tapered accurately machined seating surfaces.
- B. Provide ball bearing, cast iron floor stand with operating handwheel and position indicator.
- C. Stems:
1. Provide solid, stainless steel stems, of diameter to safely withstand opening and closing thrusts.
  2. Provide opening and closing stainless steel stop collars at top of stem.
  3. Stem couplings to be threaded and keyed.
- D. Stem guides:
1. Use cast iron, two piece, bronze bushed guides, adjustable in two directions.
  2. Space so that L/r ratio of the stem does not exceed 200.
- E. Stem cover:
1. Provide each rising stem unit with clear butyrate plastic pipe cover with mylar markings in engineering units.
  2. Provide top cover and lower end to mount in housing or adapter plate.
  3. Provide vents to prevent condensation accumulation.
- F. Provide Waterman Industries, Inc. Model MV-I2 or equal.

## 2.9 PVC BALL VALVES

- A. Provide PVC ball valves where shown on the plans.
- B. Provide true union ball valves, "Hayward True Union or equal.
- C. Provide adjustable seats.
- D. Provide Viton gaskets and seals.

## 2.10 STAINLESS STEEL BALL VALVES

- A. Provide stainless steel ball valves where indicated on the plans for threaded pipe.
- B. Valves shall have a three-piece swing-out design.
- C. Valves shall have an adjustable three-piece stem packing.
- D. Provide blowout-proof stems on valves.
- E. Valve seats are to be supported by a small stainless steel coned disc spring which provides a positive sealing force at high and low pressures.
  1. Seats are to automatically compensate for wear and thermal expansion.

- F. Seal flanges to center body section with O-rings which are fully contained and seal independently of the ball seat.
- G. Provide stem which rides on a Vespel thrust washer allowing lower operating torques and longer life.
- H. Materials of construction are as follows:
- |                          |                    |
|--------------------------|--------------------|
| Body, ball, stem, gland  | 316 SS             |
| Flanges                  | 316 SS             |
| Stem packing, ball seats | TFE                |
| Deformable glands        | Ceramic filled TFE |
| Stem thrust washer       | Vespel             |
| Coned disc springs       | 316 SS             |
| Grounding spring         | 316 SS             |
| Flanged seals            | Viton O-rings      |
| All bolts and nuts       | 316 SS             |
| Stop plate               | 316 SS             |
| Nameplate                | 302 SS             |
| Handle grip              | Vinyl              |
- I. Provide ball valves similar and equal to the Series "60" as manufactured by Whitey.

## 2.11 VALVE BOXES

- A. Provide at each buried valve.
- B. Cast iron extension type, suitable for minimum cover of 3'-6" over the pipe.
- C. Minimum inside diameter at the top of 5", minimum wall thickness 3/16.
- D. Have the word "WATER"; "SEWER"; "SLUDGE", etc., as applicable, cast into the cover.

## 2.12 PLUGS OR CAPS

- A. Provide at all pipe ends and unused branches of fittings.
- B. All plugs and caps shall be tapped 2" and provided with 2" plug.
- C. Provide restrained fittings on lines under pressure.

## 2.13 CLEANOUTS

- A. Provide Josam, J.R. Smith or equal
- B. Provide cleanouts of same nominal size as the pipes they serve; except where cleanouts are required in pipes 4" and larger, provide 4" cleanouts.
- C. Provide cast iron top for clean out at outside locations.
- D. Pour 4" concrete protection pad around cleanout at outside locations.

**2.14 HYDRANTS**

- A. Fire hydrants shall conform to ANSI/AWWA C502 and the following:
1. Waterway valve opening, 5-1/2".
  2. Six inch bell connection, two 2-1/2" hose connections, one 4-1/2" steamer connection.
  3. National Standard screw threads on outlet nozzles.
  4. Open by turning counter-clockwise with arrow cast in top indicating direction of opening.
  5. Two part breakable safety flange shall be an integral part or barrel casting.
  6. Depth of bury 3'-6".
  7. Finish coat with industrial enamel. Color determined by painting schedule.
- B. Flush-type hydrants shall be Mueller Company Catalog No. A-412, or approved equal.
1. Waterway valve opening, 2-1/8".
  2. One 2-1/2" hose connection.
  3. National Standard screw threads on outlet nozzle.
  4. Open by turning counter-clockwise with arrow cast in top indicating direction or opening.
  5. Depth of bury, 3'-0".
  6. Finish coat determined by painting schedule.
  7. Provide cap chain.
  8. Cast iron bury box, not required.
- C. Provide one hydrant wrench for each five hydrants.

**2.15 YARD HYDRANTS**

- A. Provide yard hydrants where shown on the drawings
1. Yard Hydrant as manufactured by Woodford Manufacturing model Y1 or approved equal

**2.16 GROUNDWATER (PRESSURE) RELIEF VALVES**

- A. Vertical installation:
1. Provide 4" diameter, three part construction consisting of body, cover and strainer.
  2. Provide cast bronze cover with cast iron body and strainer.
  3. Provide neoprene rubber seal.
  4. Strainer to be keyed and locked in place by rotation beyond internal plugs.
  5. Provide cover with locking design to prevent floating of parts due to rapid flow.
  6. Provide Waterman Model PRF-11 or equal.

- B. Horizontal installation:
1. Provide 4" diameter, all cast bronze flap valve and thimble assembly with soft, neoprene rubber seat for tight shut off.
  2. Angle seats for positive closing.
  3. Provide thimble with strainer locked by lugs with rotation and secured with stainless wire.
  4. Provide composition rubber gasket with stainless steel studs and nuts with wall thimble assembly.
  5. Provide Waterman Model PRB-11 or equal.

## 2.17 PIPE HANGERS AND SUPPORTS

- A. Provide pipe supports as described herein and as shown by the pipe support details provided on the Drawings.
- B. All required pipe supports may not be shown in all locations on the Drawings and details. The absence of pipe supports and/or details on any Drawing shall not relieve the Contractor of the responsibility of providing the required piping support, at the spacing specified herein, for piping shown on any Drawing.
- C. All piping shall be supported such that no excessive stress is placed on any valve, fitting or piece of equipment. Where piping connects to equipment, independent piping support shall be provided. Piping shall not be supported by a piece of equipment.
- D. Locate pipe hanger rods or other specified support mechanisms at all changes in direction or elevation of piping and at any non-rigid joints.
- E. Small piping (smaller than 3"):
1. Hangers and supports shall be fabricated from "Unistrut" channels and fittings as specified in Section 05990.
- F. Large piping (3" and larger):
1. Hangers:
    - a. Provide 304 stainless steel hangers, Anvil (Grinnell) Figure 260 (Figure 590 for ductile iron pipe and Figure 300 for insulated lines), McMaster Carr 3309, or equal.
    - b. Provide 316 stainless steel rods, coupling nuts, inserts and fasteners.
  2. Pipe supports:
    - a. Provide Grinnell Figure 264 or equal with galvanized steel pipe extension and galvanized floor flange.
    - b. Mount flange to floor with 316 stainless steel expansion anchors.
    - c. Provide 1" minimum thickness non-shrink grout under floor flange.

- G. Riser clamps:
  - 1. Provide stainless steel riser clamps on vertical pipes through sleeves, McMaster Carr 2989 or equal.
- H. All exposed piping shall be provided with supports and hangers of adequate size and configuration to support the piping system.
- I. Inserts, bolts and anchors shall be get into form work for new concrete. where hanger and anchors are to be supported by existing structures, wedge anchors shall be installed. Anchors shall be 316 stainless steel with stainless steel coupling nuts.
- J. Pressure lines shall be secured with straps or reaction blocking to prevent movement.
- K. The maximum distance between supports or hangers shall not exceed:

Pipe Diameter	Steel, Copper or Ductile Iron	PVC
3/8" diameter and smaller	4 ft.	2 ft.
1/2" diameter	6 ft.	2 ft.
3/4" and 1" diameter	8 ft.	2-1/2 ft.
1-1/4" to 2" diameter	10 ft.	3 ft.
2-1/2" diameter to 5" diameter	12 ft.	4 ft.
6" diameter and larger	12 ft.	5 ft.

**2.18 PRESSURE GAUGES**

- A. Provide pressure gauges where indicated on the drawings and not otherwise specified in separate sections of these Specifications.
  - 1. Provide rounded type case, 4-1/2" nominal diameter with phosphor-bronze bourdon tubes, glycerin filled, 1/2" HRT bottom male threaded connections stainless steel rack and pinion movement, black micro-adjusted corners and black figures with white plastic dials, and a threaded ring
  - 2. Provide gauge accurate to within 1/2% of the total scale range.
  - 3. Provide diaphragm isolators on all gauges except for those used on potable water systems.
    - a. Provide diaphragm material resistant to chemicals in the process line being measured.
  - 4. Select gauge at the range indicated on the drawings or at the nearest standard range which provides a top limit above the pump shutoff head at the operating conditions.
  - 5. Each gauge connection to consist of a shutoff valve and 1/2" stainless steal piping connections.
    - a. Shutoff valve to be 1" 316 stainless steel Whitey ball valve with Viton seals.

- B. Pressure monitoring sensor:
1. Provide pressure monitoring sensor where indicated on the plans.
  2. Provide for 360 degree pressure measurement around pipe.
  3. Provide ANSI Class 125 flanged bolt through connection.
  4. Sealing fluid to be a 50% mixture of water and ethylene glycol.
  5. Provide an auxiliary tapped and plugged port.
  6. Provide Buna-N sleeve material.
  7. Provide stainless steel body.
  8. Provide Series 40 as manufactured by Ronningen-Petter, CEJCO or approved equal.

## 2.19 AIR RELEASE AND VACUUM VALVES

- A. Provide air release valves where indicated on the drawings and not specified in other sections of these specifications.
- B. Wastewater and sludge applications:
1. Provide combination air and vacuum valves where indicated on the Drawings, and not specified in other sections of these specifications.
  2. Provide single body, cast iron, float operated combination air and vacuum valve, unless otherwise noted.
  3. Valve shall be suitable for sewage service at a working pressure of 150 psi; and capable of exhausting large amounts of air during filling, exhausting small amounts of accumulated air during operation, and admitting large amounts of air upon impending vacuum during draining.
  4. Provide a valve with 2-inch inlet and 2-inch outlet, having a 5/16-inch orifice unless otherwise noted on the Drawings.
  5. Valve shall be provided with flushing attachments consisting of an inlet isolating valve, bronze blow-off and flushing valve, and a minimum of 5 feet of rubber hose with quick disconnects.
  6. Provide GA Industries Inc., GA Fig. 942 or equal unless otherwise noted on the Drawings.
- C. Water and treated wastewater application:
1. Provide automatic air release valve to suit the pumping conditions.
  2. Locate on pump discharge head if possible if not, the Contractor shall locate valve section of piping after the discharge head.
  3. Valve shall be Crispin Deep Well Valve or equal with stainless steel trim.

## 2.20 PIPE INSULATION

- A. Provide pipe insulation where indicated on the drawings.
- B. Provide 2" thick Owens/Coming Fiberglass "25 ASJ/SSL-II".

- C. Provide smooth aluminum jacketing over insulation, Pabco Surefit Metal Products or equal.

## **2.21 MANHOLES**

- A. Use precast manholes conforming to the requirements of Section 02607.
- B. Frames and covers shall conform to the requirements of Section 02607.

## **2.22 LINK SEAL SLEEVE SEAL**

- A. Provide sleeve seals where indicated on the plans to seal between pipe sleeves and piping.
- B. Provide glass reinforced nylon plastic pressure plates.
- C. Provide 18-8 stainless steel bolts and nuts.
- D. Provide EPDM sealing element.
- E. Acceptable manufacturer is Link Seal, Type S or equal.

## **2.23 PIPE SLEEVES**

- A. Provide ductile iron pipe sleeves at locations shown on the drawings.
- B. Provide pipe sleeves with flanged wall collars located at the center of the overall sleeve length.
- C. Pipe sleeves shall be statically cast with integral wall collars or fabricated from centrifugally cast ductile iron pipe with welded on collars.
- D. Pipe sleeve diameter shall be compatible with the carrier pipe diameter and the specified type of annular space sealing method.

## **2.24 WALL PIPES**

- A. Provide ductile iron wall pipes at locations shown on the drawings.
- B. Provide wall pipes with flanged wall collars located at the center of the overall pipe length.
- C. Wall pipes shall be statically cast with integral wall collar or fabricated from centrifugally cast ductile iron pipe with welded on collars.
- D. All flanged ends and mechanical joint bell ends of wall pipes shall be tapped for studs.

**2.25 TAPPING SLEEVES AND SADDLES**

- A. Saddles: Ford Model H-10488 or Rockwell #313 Double strap saddles with epoxy coating and 304 Stainless Steel Straps and Nuts suitable for 200 psi working pressure.
- B. Sleeves: Provide full body ductile iron mechanical joint tapping sleeves, Mueller H-615/Mueller T-9 or equal, for all size on size taps. Smith-Blair Model 622-####-031 - Fabricated Steel Sleeves or equal will be acceptable for all reducing taps. Provide all sleeves with Epoxy Coating and 304 Stainless Steel Bolts. All Sleeves shall be suitable for 150 psi working pressure. Valves shall be supplied to integrally fit to the sleeve and provide connection to the existing water main without any interruption of service.

**2.26 MISCELLANEOUS PARTS AND ACCESSORIES**

- A. Use standard commercial grade suitable for the type of installation or system involved, and conforming to the applicable standards and specifications of the AWWA and approved by the Engineer.

**PART 3 EXECUTION****3.1 HANDLING, INSPECTION, AND STORAGE**

- A. Handle pipe and pipe accessories so as to ensure delivery to the point of installation in sound, undamaged condition:
  - 1. Carry pipe into position - do not drag.
  - 2. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.
  - 3. Use care not to injure pipe linings
- B. Thoroughly clean interior of pipe and accessories before installation. Keep clean during installation operations by plugging or other method approved by the Engineer.
- C. Before installation, inspect each piece of pipe and each fitting for defects:
  - 1. Material found to be defective before or after installation: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.
- D. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

**3.2 PIPE CUTTING**

- A. Cut pipe neatly and without damage to the pipe.
- B. Unless otherwise recommended by the pipe manufacturer, and authorized by the Engineer, cut pipe with mechanical cutter only.



1. Use wheel cutters when practicable for ductile iron pipe.
2. Cut plastic pipe square, using hand saw, and remove all burrs.

### 3.3 PIPE INSTALLATION - GENERAL

#### A. General:

1. Excavation and backfilling to comply with pertinent provisions of Section 02222 and 02223.
2. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Engineer.
3. Do not dump or drop any of the materials of this Section into the trench.
4. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
5. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
6. Take up and relay pipe that has the grade or joint disturbed after laying.
7. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
8. Securely close open ends of pipe, fittings, and valves when work is not in progress.
9. Where any part of coating or lining is damaged, repair to the approval of the Engineer and at no additional cost to the Owner.
10. Pipe deflection shall not exceed the pipe manufacturer's maximum recommended deflection. If deflection in excess of the maximum recommended deflection is required for alignment, the Contractor shall provide the required fittings to insure that deflection is within the acceptable limit.

#### B. Ductile iron pipe:

1. Flanged and mechanical joints, install in accordance with ANSI/AWWA 0600.
  - a. Gaskets: Handle, lubricate where necessary and install in strict accordance with manufacturer's recommendations,

#### C. Plastic pipe, gasketed joints:

1. Clean gasket, bell or coupling interior, especially groove area.
2. Lubricate and insert gasket as recommended by manufacturer.
3. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.
4. Push pipe "home until reference mark is at proper location.

#### D. Flanged joints:

1. Provide true face flanges, field clean and fit with one Pull face gasket and make bolts up finger tight.
2. Use torque wrench to alternately tighten bolts 180 degrees apart until full gasket flow and seal are secured.
3. Bias cut or unusual refacing of any flange will not be acceptable.

## E. Screw thread joints:

1. Make cuts square, with cuts thoroughly reamed and rough edges and burrs removed.
2. Wake threads sound, clean out, and well fitting.
3. Use pipe dope on male fittings only.
4. Wake screwed joints tight with all necessary wrenches but without handle extensions.

## F. Solvent weld joints:

1. Wake cuts square, remove burrs from pipe ends and bevel slightly L necessary of pipe, couplings and fittings
2. Visually inspect inside removing all dirt and moisture with clean rag.
3. Apply primer to surface of pipe and socket of fitting if required for cement being used, or lightly sandpaper surfaces.
4. Apply solvent cement evenly and quickly around the outside of the pipe at a width slightly greater than depth of fitting socket.
5. Apply a light coat of cement around the inside of the fitting socket.
6. Quickly insert pipe into fitting socket bottom and give pipe or fitting a 90 degree turn to evenly distribute the cement, hold in place to prevent fitting rebound.
7. Remove excess cement from pipe and fitting while cement is still soft.
8. Allow joints to cure at least 24 hours before applying pressure to the piping system.

### 3.4 POTABLE WATER INSTALLATION REQUIREMENTS

- A. Maintain separation of water mains from sewer and storm drain piping in accordance with "Ten States Standard" code and the latest approved version of Section R61-58.4D(12) of SCDHEC's State Primary Drinking Water Regulations as duplicated herein.

South Carolina State Primary Drinking Water Regulations - Section R61-58.4D(12)

- (a). Parallel installation - Water Mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, the Department of Health and Environmental Control may allow a deviation on a case by case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.
- (b). Crossings - Water mains crossing sewers shall be laid to provide minimum vertical distance of 18 inches between the invert of the water main and the top of the sewer. Where a water line crosses under a sewer line, both the water and sewer line must be constructed of cast iron or ductile iron. At crossing, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

- (c). Exception - The Department of Health and Environmental Control must specifically approve any variance from the requirements of the subsections (a) and (b) above when it is impossible to obtain the specified separation distances.
  - (d). Force Mains - There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossing as required in subsections (a) and (b) above.
  - (e). Sewer Manholes - No water pipe shall pass through or come in contact with any part of a sewer manhole.
  - (f). Drain-fields and Spray-fields – Potable water lines shall not be laid less than 25 feet horizontally from any portion of a wastewater tile-field or spray-field.
- B. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA Standards and/or manufacturer's recommended installation procedures.
  - C. Install pipe to indicated elevation to within tolerance of 1 inch.
  - D. Install ductile iron piping and fittings to AWWA C600.
  - E. Route pipe as shown on the plans.
  - F. Install pipe to allow for expansion and contraction without stressing pipe or joints.
  - G. Install access fittings to permit disinfection of water system performed under Section 02675.
  - H. Slope water pipe and position air release valves at high points.
  - I. Provide restrained joint piping where indicated.
  - J. Establish elevations of buried piping to ensure not less than 3 ft of cover.
  - K. Install trace wire continuous over top of all pipe. In addition, install metallic location/detection tape buried 12 inches above pipe line over all PVC pipe; coordinate with Section 02225.
  - L. Backfill trench in accordance with Section 02225.
  - M. No flushing device, chambers, pits or manholes containing valves, blow-offs, meters, air relief valves, or other such appurtenances shall be directly connected to any storm drain or sewer.
  - N. Water mains shall be located out of contaminated areas, unless using pipe materials that have been approved for this.
  - O. There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system.

- P. Cross connection devices must be installed in accordance with current SCDHEC State Primary Drinking Water Regulations.

**3.5 INSTALLATION OF SANITARY SEWER PIPE**

- A. Install gravity sanitary sewer pipe in accordance with Section 02732 - Sanitary Sewerage Systems.

**3.6 INSTALLATION OF EXPOSED PIPE**

- A. All pipe shall be installed in accordance with details as shown on the Drawings and/or as directed by the Engineer.
- B. Installation and pipe routing details shall be provided by the Contractor.
- C. Pipe shall be run parallel with or at right angles to walls, ceilings, etc. Forty-five degree (45 degrees) or angle runs shall be avoided as much as possible and installed only as approved by the Engineer.
- D. Modifications to piping installation based on actual field conditions may be required and shall receive the Engineer's approval. Changes will be provided by the Contractor at no additional cost to the Owner.
- E. Pipe coding shall be provided on all piping exposed to view, including piping in tunnels and floor or wall chases.

**3.7 SETTING VALVE BOXES**

- A. Center valve boxes on the valves, setting plumb.
- B. Tamp earth fill around each valve box to a distance of four feet on all sides, or to the undisturbed trench face if less than four feet.
- C. Fully open and close each valve to assure that all parts are in working condition.
- D. Place protective concrete slab around top of valve box as indicated on the plans.
- E. Valve stem extensions shall be provided to bring the valve operating nut to within at least 18" of finished grade, if required.
- F. Valves shall be identified and marked as required in these Specifications.

**3.8 INSTALLATION OF HYDRANTS**

- A. Inspect carefully, insuring that all foreign material is removed from the hydrant.
- B. Set plumb and at such elevation that connecting pipe and distribution main have same depth of cover.

- C. Install washed stone drainage bed and thrust blocking as indicated.
- D. Fully open and close each hydrant to assure that all parts are In working condition.

### 3.9 BACKFLOW PREVENTER

- A. Install valves in strict accordance with the manufacturer's recommendations and as approved by the Engineer and SCDHEC.
  - 1. Bolt unit to the piping as shown.
- B. Provide adapters as required for installation.
- C. Testing:
  - 1. Demonstrate all functions of the valve in the presence of the Engineer.
  - 2. Test each device by a tester as certified by the S.C. Department of Health and Environmental Control (SCDHEC).
  - 3. Tester to complete a SCDHEC test form and submit three (3) copies to the Engineer.

### 3.10 INSTALLATION OF AIR RELEASE VALVES

- A. Compact backfill thoroughly over pressure sewer.
- B. Install gravel drainage bed as shown on plans.
- C. Set valve plumb, using Schedule 80, PVC pipe between pressure sewer and valve.

### 3.11 THRUST BLOCKS

- A. General:
  - 1. Provide thrust blocks, or metal tie rods and clamps or lugs, on plugs, caps, tees, hydrants and bends deflecting 11-1/4 degrees or more either vertically or horizontally.
  - 2. Provide concrete thrust blocking with a compressive strength of 3000 psi in 28 days.
  - 3. Size of the blocking will be determined by the Engineer, based on soil bearing capacity.
- B. Installation:
  - 1. Locate thrust blocking between solid ground and the fitting to be anchored.
  - 2. Unless otherwise shown or directed by the Engineer, place the base and thrust bearing aides of thrust blocking directly against undisturbed earth.
  - 3. Sides of thrust blocking not subject to thrust may be placed against forms.
  - 4. Place thrust blocking so the fitting joints will be accessible for repair.
  - 5. Protect steel rods and clamps by galvanizing or by coating with bituminous paint.

**3.12 MANHOLES**

- A. Install manholes in accordance with the requirements of Section 02607 – Manholes and Covers, of the Specifications.

**3.13 LINK SEAL SLEEVE SEAL**

- A. Install seal between piping and sleeve.
- B. Tighten bolts to manufacturer's specified torques.
- C. Check for leaks.

**3.14 PIPE SLEEVES**

- A. Install pipe sleeves at locations shown on the plans and/or approved shop drawings.
- B. Apply specified coating to pipe sleeve prior to placement of concrete.
- C. Install link seal after carrier pipe is in place.

**3.15 WALL PIPES**

- A. Install wall pipes at locations shown on the plans and/or approved shop drawings.
- B. Install wall pipes perpendicular to wall and carefully locate each wall pipe for proper horizontal and vertical alignment.
- C. Place graphite lubricant in tapped holes of flanges and on bolt threads.

**3.16 BLIND FLANGES**

- A. Install blind flanges at locations shown on the drawings.
- B. Place graphite lubricant in tapped holes and on bolt threads for easy future removal.

**3.17 INSTALLATION - TAPPING SLEEVES AND SADDLES**

- A. Clean existing water main and remove all foreign matter from pipe. Bolt saddle or sleeve as specified into the existing line. Attach tapping valve to saddle or sleeve. Pressure test the saddle/sleeve and valve connections prior to tapping the line. Tap the line using an approved tapping machine and bit of the size specified.

3.18 HYDROSTATIC TESTING - PRESSURE LINES

A. General:

- 1. Pressure tests shall be performed by the Contractor on all completed sections of water lines in accordance with the requirements of AWWA C600, latest edition.
- 2. Water, test pump, pipe connection, pressure gauges, measuring devices, and all other necessary appurtenances to conduct tests shall be provided by the Contractor.
- 3. All line segments shall be tested at the greater of the following pressures:
  - a. a pressure of 150 pounds per square inch; OR
  - b. 1.25 times the maximum working pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the maximum working pressure at the lowest elevation of the test section.
- 4. The test section shall be slowly filled with water and all air shall be completely expelled from the section before the test pressure is applied.
- 5. The specified test pressures shall be based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.
- 6. The specified test pressure shall be maintained for not less than two hours or as long as the Engineer may require in order to detect any leakage or defective material. Any makeup water required shall be carefully measured and the leakage shall not exceed the requirements of AWWA C600-Latest edition. Any visible leakage shall be corrected. The Contractor shall use a 4½ inch diameter oil filled 0 - 200 PSIG test gage to determine the test pressure.
  - a. Allowable leakage is determined by the following formula:

For PVC or Ductile Iron Pipe:

$$L = [SD(P)^{1/2}] \div 148,000$$

Where,  
*L* = allowable leakage (gals/hr)  
*S* = length of pipeline tested (feet)  
*D* = diameter of pipe (inches)  
*P* = average test pressure (psig)

- b. An additional leakage of 0.0078 gallons per hour per inch of nominal valve size shall be allowed when testing against closed metal seated valves.
- 7. Leakage is defined as the quantity of water that must be injected into the pipeline or section of pipeline in order to maintain the required test pressure after all air has been purged from the pipe and the pipe has been completely filled with water. The piping will not be accepted until leakage is less than the number calculated using the formula given above. If leakage exceeds the calculated value, the defective joint or joints shall be located and repaired at no additional cost to the Owner.

**3.19 DISINFECTION OF WATER DISTRIBUTION LINES**

- A. Flush and disinfect all potable water lines in accordance with AWWA Standard C651, all SCDHEC requirements, and the requirements of Section 02675.

**3.20 PAINTING**

- A. Paint all exposed piping and hydrants complying with pertinent provisions of Section 09900.

**END OF SECTION**



# **SECTION 03100 CONCRETE FORMWORK**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

### **1.2 RELATED SECTIONS**

- A. Section 03200 - Concrete Reinforcement.
- B. Section 03300 - Cast-in-Place Concrete.
- C. Section 05990 - Miscellaneous Metals.

### **1.3 UNIT PRICE - MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 REFERENCES**

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 347 - Recommended Practice For Concrete Formwork.
- D. ASME A17.1 - Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks
- E. PS 1 - Construction and Industrial Plywood.

### **1.5 DESIGN REQUIREMENTS**

- A. Design, engineer and construct formwork, shoring and bracing to conform to [design and] code requirements; resultant concrete to conform to required shape, line and dimension.

**1.6 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
- C. Product Data: Provide data on void form materials and installation requirements.

**1.7 QUALITY ASSURANCE**

- A. Perform Work in accordance with ACI 347, 301, and 318.
- B. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of South Carolina.

**1.8 REGULATORY REQUIREMENTS**

- A. Conform to applicable codes for design, fabrication, erection and removal of formwork.

**1.10 DELIVERY, STORAGE, AND PROTECTION**

- A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.
- B. Deliver void forms and installation instructions in manufacturer's packaging.
- C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

**PART 2 PRODUCTS****2.1 WOOD FORM MATERIALS**

- A. Use form materials conforming to ACI 347.
- B. Form lumber: Use lumber of sufficient quality and grade, size and stiffness to adequately support the work and insure dimensional accuracy.
- C. Form ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole.
  - 1. Use ties with cones that allow a 1" break back and facilitate patching
  - 2. On structures containing water or other liquid or below grade structures, use embedded rod ties with integral waterstops in addition to cones.
  - 3. Wire ties and wood spreaders will not be permitted.
- D. Form coatings: Form release coating shall be neat oil with surface wetting agent or chemical release agent which effectively prevents absorption of moisture, prevents

bonding with concrete, is non-staining to concrete and leaves the concrete with a paintable surface.

- E. Chamfer strips: Chamfer strips shall be wood or polyvinyl strips or approved equal, designed to be nailed in the forms to provide a 3/4 inch chamfer (unless indicated otherwise) at all exposed edges and corners of concrete members,

## 2.2 PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Preformed Plastic Forms: Thermoplastic or Polyurethane elastomer form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- D. Pan Type: Steel or Glass fiber of size and profile required.
- E. Tubular Column Type: Round, spirally wound laminated fiber or glass fiber material, surface treated with release agent, non-reusable, of sizes required.
- F. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 4 inches thick.

## 2.3 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off type, galvanized steel, fixed length, cone type, with waterproofing washer 1 inch back break dimension, free of defects that could leave holes larger than 1-1/4 inch in concrete surface.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Corners: Chamfered, rigid plastic or wood strip type; 3/4 inch x 3/4 inch size; maximum possible lengths.
- D. Flashing Reglets: Galvanized steel 22 gage, longest possible lengths, with alignment splines for joints, foam filled release tape sealed slots, anchors for securing to concrete formwork.
- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

- F. Waterstops:
  - 1. See Section 03250 – Concrete Accessories.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Construct forms in conformance with ACI 347.
- B. Design, erect, support, brace and maintain formwork so formwork can safely support vertical and lateral loads which might be applied until such loads can be supported safely by the concrete structure.
- C. Construct forms to the exact sizes, shapes, lines and dimensions shown and as required to obtain accurate plumb work in alignment, location, grades, level and the finished structure.
- D. Provide Formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and prevent fins.

### **3.2 EXAMINATION**

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

### **3.3 EARTH FORMS**

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

### **3.4 FORM CONSTRUCTION AND ERECTION:**

- A. Construct Forms in conformance with ACI 301 and 347 to achieve design requirements. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads. Align joints and make watertight. Keep form joints to a minimum.
- B. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts and other embedded items as required. Obtain approval before framing openings in structural members which are not indicated on Drawings.

- E. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders approved by the Engineer.
- F. Unless specifically stated otherwise, provide 3/4" chamfer at all exposed edges of concrete.
- G. Provide temporary openings in the formwork where necessary to facilitate cleaning and inspection of the formwork.
- I. Do not allow excess form coating material to accumulate in the forms or to come in contact with reinforcing surfaces which will bond to fresh concrete.
- J. Side forms for Footings may be omitted, and concrete may be placed directly against excavation only when requested by the Contractor and approved by the Engineer.
- K. Provide a positive means of adjustment of shores and struts and insure that all settlement is taken up during concrete placing.
- L. Construct blockouts and formed openings of sufficient size and proper location to permit final alignment of items within it or passing through it.
  - 1. Allow sufficient space for grouting, packing or sealing around any items penetrating the opening as may be required to ensure watertightness.
  - 2. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrapped air during grouting.
  - 3. Provide only blockouts or openings that are shown on the drawings or otherwise approved by the Engineer.
- M. Coordinate this section with other sections of work which require attachment of components to formwork.
- N. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.
- O. Do not permit steel spreaders form ties, or other metal to project from or be visible on any concrete surface except where so shown on the drawings.

### **3.5 APPLICATION - FORM RELEASE AGENT**

- A. Coat form contact surfaces with approved form coating compound in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

**3.6 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals specified in Section 04300.
- E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- F. Install waterstops in accordance with manufacturer's instructions continuous without displacing reinforcement. Heat seal joints watertight.
- G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

**3.7 FORM CLEANING**

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

**3.8 FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.
- C. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301.

### 3.9 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- C. Formwork reuse: Reuse only forms that are in good condition and which maintain a form surface texture on expose concrete surfaces.
  - 1. Apply a light sanding as necessary to obtain a uniform texture.
  - 2. Plug unused tie holes and penetrations flush with the form surface.

### 3.10 FORM REMOVAL

- A. Do not disturb or remove forms or bracing until concrete has hardened sufficiently and has gained sufficient strength to carry its own weight and imposed loads with complete safety. Do not remove shoring until the member has acquired sufficient strength to support its own weight, the load upon it, and the added load of construction,
- B. Do not remove forms before the following minimum times without prior approval from the Engineer:
  - 1. Sides of footings or slabs on grade 24 hrs.
  - 2. Walls not supporting load 48 hrs.
  - 3. Vertical sides of beams 48 hrs.
  - 4. Columns not supporting load 48 hrs.
  - 5. Suspended slabs or beam bottoms (forms only) 10 days.
- C. In determining the minimum stripping times, consider only the cumulative time during which the ambient temperature of the air surrounding the concrete is above 50 degrees.
- D. Do not remove shoring for suspended slabs or beams until the concrete has reached 75% of the specified 28 day strength.
- E. When reshoring or backshoring is permitted or required, plan the operations in advance and submit procedures to the Engineer for approval.
  - 1. Design and plan all reshoring operations to support all construction loading and in accordance with ACI 347.
- F. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged and that corners are true, sharp and unbroken. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- G. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

- H. Whenever the Formwork is removed during the curing period, continue to cure the exposed concrete by one of the methods specified in Section 03370.

**3.11 SCHEDULES**

- A. Site fabricated plywood coated with form oil shall be used on all Architectural concrete and as directed by the Engineer
- B. Prefabricated forms are acceptable on all other applications unless otherwise specified by the Engineer.

**END OF SECTION**



# **SECTION 03200 CONCRETE REINFORCEMENT**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

### **1.2 RELATED SECTIONS**

- A. Section 03100 - Concrete Formwork.
- B. Section 03300 - Cast-in-Place Concrete.

### **1.3 UNIT PRICE - MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 REFERENCES**

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements For Reinforced Concrete.
- C. ACI SP-66 - American Concrete Institute - Detailing Manual.
- D. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- E. ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- F. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- G. ASTM A496 - Deformed Steel Wire Fabric for Concrete Reinforcement.
- H. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- I. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- J. ASTM A616 - Rail Steel Deformed and Plain Bars for Concrete Reinforcement.
- K. ASTM A617 - Axle Steel Deformed and Plain Bars for Concrete Reinforcement.
- L. ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

- M. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
- N. ASTM A767 - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
- O. ASTM A775 - Epoxy-Coated Reinforcing Steel Bars.
- P. ASTM D3963 - Epoxy-Coated Reinforcing Steel.
- Q. AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- R. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- S. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.
- T. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
- U. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

**1.5 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Shop Drawings: Submit the following shop drawings to the Engineer for approval prior to commencing work:
  - 1. Reinforcing steel drawings: Prepare in accordance with ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, dimensions and details of bar reinforcing and accessories.

**1.6 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Submit certified copies of mill test report of reinforcement materials analysis.

**1.7 QUALITY ASSURANCE**

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, ACI SP-66, ACI 318, and ASTM A184.
- B. Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

- C. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of South Carolina.
- D. Welders' Certificates: Submit under provisions of Section 01400, Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

## **PART 2 PRODUCTS**

### **2.1 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615, 60 ksi yield strength, deformed billet steel bars, unfinished, or epoxy coated in accordance with ASTM D3963 where noted on the drawings.
- B. Reinforcing Steel Mat: ASTM A704, ASTM A615, 60 ksi yield strength; steel bars or rods, unfinished.
- C. Stirrup Steel: ASTM A82, unfinished or epoxy coated in accordance with ASTM D3963 where noted on the drawings.
- D. Welded Steel Wire Fabric: ASTM A497 Welded Deformed Type; in flat sheets, unfinished or epoxy coated in accordance with ASTM D3963 as noted on the drawings.

### **2.2 ACCESSORIES**

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel type; size and shape as required.

### **2.3 FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice, ACI SP-66, ACI 318, and ASTM A184.
- B. Weld reinforcement in accordance with AWS D1.4 and AWS D12.1 as applicable.
- C. Epoxy Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.
- D. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Engineer.

## **PART 3 EXECUTION**

### **3.1 PLACEMENT**

- A. Place reinforcement as shown on the drawings. Support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Unless otherwise noted, maintain concrete cover around reinforcing in accordance with ACI 350.

### **3.2 FIELD QUALITY CONTROL**

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Inspect for acceptability and proper placement.

### **3.3 SCHEDULES**

- A. All reinforcement shall be unfinished unless noted otherwise on the Drawings.

**END OF SECTION**

# **SECTION 03250 CONCRETE ACCESSORIES**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- A. Related materials as needed for a complete and proper installation of concrete.

### **1.2. RELATED SECTIONS**

- A. Section 03100 - Concrete Formwork: Formwork and accessories.
- B. Section 03200 - Concrete Reinforcement.
- C. Section 03340 - Concrete Finishing.
- D. Section 03370 - Concrete Curing.
- E. Section 03600 - Non-Shrink Grout.
- F. Section 07920 - Caulking and Sealants.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment will be made for work performed under this section. The cost of all work covered by this section of the specifications shall be included in the lump sum price as bid for the project.

### **1.4 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittals

### **1.5 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are trained, experienced and completely familiar with the specified requirements and the methods needed for proper installation and performance of the work of this Section.
- B. Follow the manufacturer's instructions for preparation and use of proprietary items.

## **PART 2 - PRODUCTS**

### **2.1 WATERSTOP MATERIALS**

- A. Provide waterstops at all joints in structures containing liquid or resisting hydrostatic pressure, including structures below grade, basins, etc., and as shown on the drawings.
  - 1. Expansion joints: 9" Wide x 3/8" minimum thick center bulb lock rib type.

2. Construction Joints (PVC): Use minimum 6" wide x 3/8" thick lock rib type polyvinyl chloride (PVC) waterstop, minimum 1,750 psi tensile strength, minimum 50 degrees F to 175 degrees F working temperature range, 6 inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.
3. Construction Joints, Expanding hydrophilic rubber (EHR): Hydrotite by Greenstreak or Ultraseal MC2010 MN by Adeka, or equal.

B. Expansion Joint Filler

1. For interior work, use asphalt impregnated cellulose fiber joint fillers complying with ASTM D 1751.
2. Self-expanding cork joint fillers complying with ASTM D 1752, Type III, for exterior work.

## 2.2 MOISTURE BARRIER

A. Where so indicated on the Drawings, provide a moisture barrier consisting of:

1. Clean gravel base of thickness as indicated on the drawings, but not less than 4".
2. Six mil thick plastic sheeting, with all joints taped and sealed.

## 2.3 ANCHORING AND BONDING MATERIALS

A. Epoxy adhesive: Use high strength epoxy adhesive conforming to ASTM C 881.

1. Provide Sikadur 32 Hi-Mod by Sika Corporation, Epobond by L&M Construction Chemicals, Inc., Bond-1 by Permagine Industries, Inc. or approved equal.
2. Mix epoxy components as recommended by the epoxy manufacturer when required by the use intended.

B. Bonding agents: Use polyvinyl acetate homopolymer liquid bonding agent.

1. Use Weld Crete by Larsen; or
2. Everweld by L&M Construction Chemicals, Inc.; or
3. Approved equal.

C. Bonding admixtures: Use acrylic latex or acrylic polymer liquid bonding admixtures.

1. Use Acryl 60 by Thoro System Products; or
2. Everbond by L&M Construction Chemicals, Inc.; or
3. Sikabond by Sika Corporation; or
4. Mix in accordance with manufacturer's instructions.

## 2.4 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation of concrete accessories, as selected by the Contractor subject to the approval of the Engineer.

## **PART 3 - EXECUTION**

### **3.1 WATERSTOPS**

- A. General: Provide waterstops in construction or expansion joints of all structures subject to hydrostatic pressure and as indicated on the drawings.
- B. PVC Waterstops:
  - 1. Waterstops to be installed in all wall or slabs construction joints which will hold water and where indicated in the drawings
  - 2. Extend waterstops the entire length of the joint.
  - 3. Install waterstops splices where necessary and test as recommended by the manufacturer.
  - 4. Center the waterstop in the joint unless shown otherwise.
  - 5. Securely fastened waterstop to reinforcing or concrete form every 12 inches.
- C. Installation of expanding hydrophilic rubber waterstops
  - 1. Secure the rubber strip in place in accordance with the manufacturer's instructions.
  - 2. Lap 2" of the waterstop where a splice occurred and apply paste over the joint.
  - 3. Comply with manufacturer's installation instructions.

### **3.2 MOISTURE BARRIER**

- A. Do not tear or damage barrier
- B. Tape all joints

**END OF SECTION**





# **SECTION 03300 CAST-IN-PLACE CONCRETE**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Cast-in-place concrete for floors, walls, suspended floors, and beams including curing, finishing, formwork, and reinforcement where shown on the Drawings and as specified herein, and as required for a complete and proper installation.
- B. Floors and slabs on grade.
- C. Control, expansion and contraction joint devices associated with concrete work including joint sealants.
- D. Equipment pads, light pole bases, flagpole bases, thrust blocks, manholes, and other items shown to be made of cast in place concrete.

### **1.2 RELATED SECTIONS**

- A. Section 03100 - Concrete Formwork: Formwork and accessories.
- B. Section 03200 - Concrete Reinforcement.
- C. Section 03340 - Concrete Finishing.
- D. Section 03370 - Concrete Curing.

### **1.3 UNIT PRICE - MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 REFERENCES**

- A. ACI 211.1 - Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- B. ACI 211.2 - Selecting Proportions for Structural Lightweight Concrete.
- C. ACI 301 - Structural Concrete for Buildings.
- D. ACI 302 - Guide for Concrete Floor and Slab Construction.
- E. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

- F. ACI 305R - Hot Weather Concreting.
- G. ACI 306R - Cold Weather Concreting.
- H. ACI 308 - Standard Practice for Curing Concrete.
- I. ACI 318 - Building Code Requirements for Reinforced Concrete.
- J. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- K. ASTM C33 - Concrete Aggregates.
- L. ASTM C94 - Ready-Mixed Concrete.
- M. ASTM C150 - Portland Cement.
- N. ASTM C260 - Air Entraining Admixtures for Concrete.
- O. ASTM C330 - Light Weight Aggregates For Structural Concrete.
- P. ASTM C494 - Chemical Admixtures for Concrete.
- Q. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- R. ASTM C948 - Test Method for Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber-Reinforced Concrete.
- S. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- T. ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.
- U. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- V. ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

**1.5 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide manufacturer's specifications with application instructions for proprietary materials and items including joint devices, attachment accessories, admixtures, curing compounds, form release agents, patching compounds, and other materials as requested by the Engineer.

- C. Concrete Mix Design: Submit for approval the proposed mix designs for each strength concrete to be used within 30 calendar days of receipt of the Owner's Notice to Proceed.
  - 1. Proportions shall be determined by means or laboratory tests of concrete made with the cement and aggregate proposed for use.
  - 2. Provide report in detail from an approved testing laboratory showing 7-day and 28-day strengths obtained using materials proposed.
  - 3. Required average strength above specified strength:
    - a. Determinations of required average strength (f'c) above specified strength shall be in accordance with ACI 318 and ACI 301.
    - b. Establish the required average strength of the assign mix using the materials proposed to be employed. Standard deviations shall be determined by thirty tests. Average strength used for selecting proportions shall exceed specified strength (F'c) by at least:
      - i. 400 psi - Standard deviation is less than 300
      - ii. 550 psi - Standard deviation is 300 to 400
      - iii. 700 psi - Standard deviation is 400 to 500
      - iv. 900 psi - Standard deviation is 500 to 600
      - v. 1200 psi - Standard deviation is above 600 or unknown
    - c. When the ready-mix producer does not have a record of past performance the combination of materials and the proportion selected shall be selected from trial mixes having proportions and consistencies suitable for the work using at least three (3) different water/cement ratios which will produce a range of strengths encompassing those required. Average strength required shall be 1200 psi above specified strength.
  - 4. Cost of this work shall be borne by the Contractor.
- D. Shop Drawings: Submit the following shop drawings to the Engineer for approval prior to commencing work:
  - 1. Reinforcing steel drawings: Prepare in accordance with ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, dimensions and details of bar reinforcing and accessories.

**1.6 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

**1.7 SUBMITTALS AT PROJECT CLOSEOUT**

- A. Section 01700 - Contract Closeout: 01730 - Operation and Maintenance Data: 01740 - Warranties and Bonds: Procedures for submittals.
- B. Accurately record actual locations of embedded utilities and components which are concealed from view.

**1.8 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. Perform Work in accordance with applicable sections of the ACI, ASTM, CRSI, and AWS Codes.
- C. Testing Agency: An independent testing laboratory shall be selected by the Owner and retained by the Contractor to perform material evaluation tests as required by these specifications.
- D. Qualifications of contractors performing concrete work: Minimum of two (2) years experience on comparable concrete projects.
- E. Plant qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C94.

**1.9 MOCK-UP**

- A. Section 01400 - Quality Control: Requirements for mock-up.
- B. Construct and erect a field sample for architectural concrete surfaces receiving special treatment or finish as result of formwork.
- C. Sample Panel: Sufficient size to indicate special treatment or finish required.
- D. If requested by Architect/Engineer, cast concrete against sample panel. Obtain acceptance of resultant surface finish prior to erecting formwork.
- E. Accepted sample panel is considered basis of quality for the finished work. Keep sample panel exposed to view for duration of concrete work.

**PART 2 PRODUCTS**

**2.1 CONCRETE MATERIALS**

- A. Portland cement: ASTM C150, Type I – Normal, Type IA - Air Entraining, Type 1-P, or Type II.
- B. Aggregates:
  - 1. Fine Aggregate: ASTM C33
  - 2. Coarse Aggregate: ASTM C33, Size #57
- C. Water: Clean, potable, free from deleterious material and not detrimental to concrete.

- D. Glass Fiber Reinforcement: ASTM C948. Polypropylene or co-polymer fibers as manufactured by High Tech Fibers, Inc., or Fibermesh Fibers as manufactured by the Fibermesh Company, or approved equal.

## 2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical: ASTM C494
  - 1. Type A - Water Reducing
  - 2. Type B - Retarding
  - 3. Type C - Accelerating
  - 4. Type D - Water Reducing and Retarding
  - 5. Type E - Water Reducing and Accelerating
  - 6. Type F - Water Reducing, High Range
  - 7. Type G - Water Reducing, High Range and Retarding
- C. Fly Ash, Calcinated Pozzolan: ASTM C618.
- D. Admixtures containing calcium chloride will not be permitted.
- E. Fibermesh admixture, where required shall be Fibermesh 150 or equal, applied at a rate of not less than 1.5 lbs per cubic yard of concrete. Fibermesh shall meet the requirements of ASTM C1116/C 1116M, Type III for fiber reinforced concrete.

## 2.3 ACCESSORIES

- A. Bonding Agent: Polymer resin emulsion or Latex emulsion.
- B. Vapor Retarder: 6 mil thick clear polyethylene film or fabric reinforced plastic film of a type recommended for below grade application.
- C. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

## 2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type C: ASTM D1752; Premolded sponge rubber fully compressible with recovery rate of minimum 95 percent. Use where joint filler is indicated on the Drawings.
- B. Sealant and Primer: As specified in Section 07920.

## 2.5 CONCRETE MIX

- A. Production of concrete:
1. Concrete shall be ready mixed. Batch, mix and deliver concrete in accordance with ASTM C94, unless otherwise indicated. Select proportions for concrete in accordance with ACI 301 and ACI 211.1 as applicable.
  2. Monitor time and mix proportions by plant delivery slips.
  3. Add air entrainment admixture to concrete as a solution and measure by means of an approved mechanical dispensing device.
  4. Add water reducing and retarding admixture and measure as recommended by the manufacturer.
  5. Addition of water to the mix upon arrival at the job site shall not exceed that necessary to compensate for a 1 inch loss in slump. In no case shall the design maximum water/cement ratio be exceeded. Water shall not be added to the batch at any later time.
  6. Control the temperature of the concrete mix as required by ACI 305 or ACI 306 as necessary.
- B. Provide concrete to the following criteria:
1. Provide concrete with the compressive strengths shown on the Drawings. When strengths are not shown, provide the following 28 day strengths at a minimum:
 

a. Sidewalks, curbs and gutters, and unreinforced foundations	3000 psi
b. Thrust blocking, backfill, pipe encasement, and concrete fill	2500 psi
c. Prestressed or precast concrete	5000 psi
d. All other structural concrete	4000 psi
  2. Maximum water/cement ratios:
 

a. 4000 psi concrete	0.47
b. 3000 psi concrete	0.53
c. 2500 psi concrete	0.65
  3. Required air entrainment:
 

a. 3000 and 4000 psi concrete	5% ± 1%
b. 2500 psi concrete	not required
  4. Maximum slump:
 

a. 3000 and 4000 psi concrete	4" ± 1"
b. 2500 psi concrete	5" ± 1"
- C. Use accelerating admixtures in cold weather only when approved by the Engineer. Use of admixtures will not relax cold weather placement requirements.
- D. Use of calcium chloride not approved.
- E. Use set retarding admixtures during hot weather only when approved the Engineer.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify site conditions under which work of this section is to be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Water, mud, debris, and organic and other deleterious material shall be removed from excavations and formwork prior to placement of concrete.
- C. Verify requirements for concrete cover over reinforcement.
- D. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
- E. Notify the Engineer prior to placement of concrete. Place no concrete until formwork, reinforcing, and embedded items have been inspected by the Engineer.

### **3.2 PREPARATION**

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with epoxy or non-shrink grout as directed by the Engineer.
- C. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by sealant applied between overlapping edges and ends.
- D. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.
- E. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.
- F. Remove foreign matter accumulated in the forms.
- G. Rigidly close openings left in the formwork.
- H. Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to maintain workability of the concrete.
- I. Use only clean tools.

- J. Provide sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete.
- K. Prior to commencing placement of concrete, inspect and complete installation of formwork, reinforcing steel, vapor barrier, and all items to be embedded or cast in.

**3.3 CONVEYING**

- A. Transport and handle concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete.
- B. Provide equipment for lifting, dumping, chuting, pumping or conveying the concrete, of such size and design as to insure a practically continuous flow of concrete at the delivery and without separation of materials.
- C. Use hoppers and elephant trunks where necessary to prevent the free fall of concrete For more than 8 feet.
- D. Do not use concrete that is not placed within 1-1/2 hours after water is first introduced into the mix unless the slump is such that it meets the specified limits without the addition of water to the batch.

**3.4 PLACING CONCRETE**

- A. Notify Engineer minimum 24 hours prior to commencement of operations.
- B. Place concrete in accordance with all applicable provisions of ACI Codes.
  - 1. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to rehandling and flowing.
  - 2. Deposit concrete in horizontal layers not deeper than 2 feet, avoiding inclined layers.
  - 3. Place concrete in such a manner that concrete upon which fresh concrete is deposited is still plastic.
  - 4. Bring slab surfaces to the correct levels with screeds set to the proper elevations. Screed slabs level, maintaining surface flatness of maximum 1/4 inch in 10 ft.
- C. Hot weather placement: Place concrete in hot weather in accordance with ACI 305 "Hot Weather Concreting" and as specified herein.
  - 1. Do not place concrete whose temperature exceeds 100 degrees F.
  - 2. Thoroughly wet forms and reinforcing prior to placement of concrete.
  - 3. Use additional set retarder as necessary to increase set time.
  - 4. Limit the size of the pour where it may reduce the likelihood of cold joints due to reduced set time.
  - 5. Shade the fresh concrete as soon as possible after placing.
  - 6. Start curing as soon as the concrete is sufficiently hard to permit without damage.



- D. Cold weather placement: Place concrete in cold weather in accordance with ACI 306 and as specified herein.
  - 1. Except when authorized specifically by the Engineer, do not place concrete when the atmospheric temperature is below 40 degrees F.
  - 2. When cold weather placement is approved by the Engineer, heat either the mixing water or aggregate or both so that the concrete temperature is between 65 degrees F and 85 degrees F.
  - 3. Protect the freshly Placed concrete by adequate housing or covering and provide heat to maintain a temperature of not less than 50 degrees F for not less than four days.
  - 4. Do not add salts, chemicals, or other materials to the concrete mix to lower the freezing point of the concrete.
  
- E. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
  
- F. Consolidation:
  - 1. Consolidate each layer of concrete immediately after placing by use of internal concrete vibrators supplemented by hand spading, rodding or tamping.
    - a. Use vibrators having a 2" head diameter and a minimum frequency of 8000 vibrations per second.
    - b. Provide sufficient number of vibrators to properly consolidate the concrete, keeping up with placement operations.
    - c. Provide at least one spare vibrator on site.
  - 2. Insert and withdraw vibrators at points approximately 18 inches apart.
  - 3. Do not vibrate forms or reinforcement.
  - 4. Do not use vibrators to transport concrete inside the forms.
  
- G. Protection:
  - 1. Protect the surface finish of newly placed concrete from damage by rainwater or construction traffic.
  - 2. Do not apply design loads to structures until the concrete has obtained the specified strength.
    - a. Do not backfill against walls until they have reached the specified strength and all supporting or bracing walls, slabs, etc. have also reached the specified strength, unless otherwise permitted by the Engineer.
    - b. Protect structures from construction overloads.
  
- H. Joints
  - 1. Construction joints:
    - a. Unless otherwise approved by the Engineer, provide construction joints as shown on the drawings.
    - b. If additional construction joints are found to be required, secure the Engineer's approval of joint design and location prior to start of concrete placement.

- c. Continue all reinforcing across construction joints and provide 1-1/2" deep keyways unless indicated otherwise on the drawings.
  - d. Provide waterstops in all construction joints of liquid containing structures, structures below grade or other structures as shown on the drawings.
  - 2. Expansion joints:
    - a. Provide expansion joints or size, type and locations as shown on the drawings.
      - i. Do not permit reinforcement or other embedded metal items that are being bonded with concrete (except smooth dowels bonded on only one side of the joints, where indicated on the drawings) to extend continuously through any expansion joint
    - b. Provide waterstops as required.
  - 3. Control or contraction joints:
    - a. Locate and construct control and contraction joints in accordance with the drawings.
    - b. Where no specific joint pattern is indicated in slabs on grade or concrete pavements, submit a proposed joint layout to the Engineer for approval.
    - c. Where no specific joint details are shown on the drawings joints may be tooled, preformed or saw-cut.
    - d. Saw-cut joints as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw.
- I. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.
- J. Place joint filler in floor slab. Set top to required elevations. Secure to resist movement by wet concrete.
- K. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.
- L. Install joint devices in accordance with manufacturer's instructions.
- M. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- N. Install joint device anchors. Maintain correct position to allow joint cover to be flush with finished surface.
- O. Install joint covers in longest practical length, when adjacent construction activity is complete.
- P. Apply sealants in joint devices in accordance with Section 07920.
- Q. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- R. Place concrete continuously between predetermined expansion, control, and construction joints.
- S. Do not interrupt successive placement; do not permit cold joints to occur.

- T. Place floor slabs in checkerboard pattern or saw cut as indicated by the Engineer.
- U. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- V. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/4 inch per foot nominal, or as indicated on drawings.

**3.5 SEPARATE FLOOR TOPPINGS**

- A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Place required dividers, edge strips, reinforcing, and other items to be cast in.
- C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
- D. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels, dimension not to exceed 20 ft .
- E. Screed toppings level, maintaining surface flatness of maximum 1:1000.

**3.6 CONCRETE FINISHING**

- A. Finish concrete surfaces in accordance with ACI 301 and Section 03340.

**3.7 CURING AND PROTECTION**

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure concrete floor surfaces to requirements of Section 03370 and in accordance with ACI 308.
- D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.
- E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

**3.8 FIELD QUALITY CONTROL**

- A. Section 01400 - Quality Assurance, 01650 - Starting of Systems: Field inspection and testing.

- B. Provide free access to Work and cooperate with appointed firm.
- C. Submit proposed mix design for each class of concrete to be used to testing firm for review prior to commencement of Work.
- D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- E. Concrete cylinder tests:
  - 1. During construction, prepare test cylinders for compressive strength testing, using 6 inch diameter by 12 inch long single use molds, complying with ASTM C31.
    - a. Make a set of four test cylinders from each pour of 50 cubic yards or less, Plus one additional set of cylinders for each additional 50 cubic yards or fraction thereof. This requirement shall be for each class of concrete to be placed.
    - b. Identify each and tag cylinder as to date of pour and location of concrete which it represents.
    - c. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
    - d. Deliver cylinders to testing lab. See Section 01410 – Testing Services for requirements.
    - e. Cost For preparation, delivery, and testing of cylinders shall be borne by the Contractor.
  - 2. Should strengths shown by test cylinders fail to meet specified strengths for the concrete represented, then:
    - a. Engineer shall have the right to require changes in the mix proportions as he deems necessary on the remainder of the work.
    - b. Additional curing of those portions of the structure represented by the failed test cylinders shall be accomplished se directed by the Engineer.
    - c. Upon failure of the additional curing to bring the concrete up to specified strength requirements, strengthening or replacement of those portions of the structure shall be as directed by the Engineer.
    - d. The Engineer may require additional testing of concrete in question by either non-destructive methods such as the Swiss Hammer, Windsor Probe or Ultrasonics or by coring and testing the concrete in question in accordance with ASTM C42. Such testing shall be performed at no additional coat to the Owner.
- F. Other field concrete tests:
  - 1. Slump tests: Either the Engineer or a testing laboratory representative will make slump tests of concrete as it is discharged from the mixer.
    - a. Slump test may be made on any concrete batch at the discretion of the Engineer
    - b. Failure to meet specified slump requirements (prior to addition of any superplasticizers) will be cause for rejection of the concrete.
  - 2. Temperature: The concrete temperature may be checked at the discretion of the Engineer

3. Entrained air: Air content of the concrete will be checked by a representative of the testing laboratory at the discretion of the Engineer.
  4. One slump test will be taken for each set of test cylinders taken.
- G. Coordination of laboratory services: The Contractor shall be responsible for coordination of laboratory services.
1. Maintain a log recording quantities of each type of concrete placed, date and location of pour.
  2. Inform the testing laboratory of locations and dates of concrete placement and other information as required to be identified in the laboratory's test reports.
- H. Tests required because of extensive honeycombing, poor consolidation of the concrete or any suspected deficiency in the concrete will be paid for by the Contractor.
- I. Dimensional tolerances:
1. Dimensional tolerances for allowable variations from dimensions or locations of concrete work, including the locations of embedded items shall be as given in ACI 301.
    - a. Where anchor bolts or other embedded items are required for equipment installation, comply with the manufacturer's tolerances if more stringent than those stated in ACI 301.
- J. Watertight concrete:
1. All liquid containing structures, basements or pits below grade shall be watertight.
  2. Any visible leakage or seepage shall be repaired as instructed by the Engineer at no expense to the Owner.
  3. Where physical evidence of honeycombing, cold joints or other deficiencies which may impair the watertightness of a structure exist, the Engineer may at his discretion call for leak testing of the structure.
    - a. Fill the structure with water and allow to stand for not less than 48 hours.
    - b. Make repairs on the structure until all visible leaks are sealed and the leakage rate of the water in the structure is less than 0.19 of the volume held in the structure per day.
    - c. The cost of testing and repairs shall be performed at no expense to the Owner.
- K. Concrete which fails to meet strength requirements dimensional tolerances watertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the Engineer at no expense to the Owner.

### **3.9 PATCHING**

- A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
- C. Patch imperfections in accordance with ACI 301 or as directed.

**3.10 DEFECTIVE CONCRETE**

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

**3.11 SCHEDULE - CONCRETE TYPES**

- A. Class A: 4000 psi
- B. Class B: 3000 psi
- C. Class C: 2500 psi

Unless otherwise noted, all concrete shall be Class A.

**END OF SECTION**

# **SECTION 03340 CONCRETE FINISHING**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Finish of Cast-in -place concrete.

### **1.2 RELATED SECTIONS**

- A. Section 03100 - Concrete Formwork.
- B. Section 03300 - Cast In Place Concrete.
- C. Section 03600 - Non-Shrink Grout

### **1.3 UNIT PRICE - MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide data indicating description of Products to be supplied.

### **1.5 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturer's Instructions: Indicate special procedures required to apply Products specified.
- C. Certificates: Certify that products meet or exceed specified requirements.

### **1.6 QUALITY ASSURANCE**

- A. Perform work in accordance with ACI 301 and ACI 302.

### **1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver finishing materials in Manufacturer's packaging, including application instructions. Protect products from damage due to the elements and construction activity.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Cementitious coatings shall provide a waterproof, textured coating for concrete and masonry surfaces.
  - 1. Coating shall bond permanently and become an integral part of the finished surface.
  - 2. Finish shall be applied by either trowel and float or spray application.
  - 3. Product shall be Thoroseal Plaster Mix or an approved equal.
  
- B. Acrylic textured coatings shall provide a waterproof, textured coating for concrete, masonry, plaster, and other cementitious coatings. Application shall provide a uniform color to the finished surface. Product shall meet the requirements of ASTM E84-75. Color of coating as determined by the Engineer

## **PART 3 EXECUTION**

### **3.1 FINISH SCHEDULE**

- A. Unless otherwise indicated on the drawings, finish all concrete surfaces as specified herein.
  
- B. Form finish: Formed surfaces not ordinarily exposed to view, including:
  - 1. Interior walls of open tanks below a line one foot lower than the lowest normal water level.
  - 2. The underside of slabs not exposed to view.
  - 3. Walls below grade.
  
- C. Cementitious coating: All formed surfaces exposed to view including:
  - 1. Interior walls of tanks above a line one foot lower than the lowest normal water level.
  - 2. The underside of slabs, soffits, etc. exposed to view.
  - 3. Any other exposed walls, columns, and beams.
  
- D. Float finish: Slab surfaces not exposed to view or not receiving an applied thin finish, including:
  - 1. Bottom slabs of tanks or structures containing water sewage or other liquid.
  - 2. Foundations not exposed to view.
  - 3. Roof slabs to be covered with insulation and/or built-up roofing.
  
- E. Trowel finish: Interior slab surfaces exposed to view or to receive an applied thin film coating or floor finish, including:
  - 1. Interior, indoor slabs and floors of buildings.



2. Surfaces on which mechanical equipment moves.
  3. Floors receiving vinyl tile, resilient flooring, carpet, paint etc.
- F. Broom finish: Exterior, outdoor slabs exposed to view including:
1. Outdoor floor slabs and walkways.
  2. Other floors which may become wet or otherwise require a non-skid surface.
  3. Sidewalks and concrete pavements.
- G. Scratch finish: Surfaces which are to receive a thick topping or additional concrete cast against them including:
1. Surfaces receiving concrete equipment pads.
  2. Floors receiving concrete topping.
  3. Construction joints not otherwise keyed.
- H. Edge finish: Exposed edges of slabs not receiving chamfer including:
1. Sidewalk edges and joints.
  2. Pavement edges and joints.
  3. Other slab edges not chamfered.

### 3.2. FINISHING PROCEDURES

- A. Form finish:
1. Repair defective concrete.
  2. Fill depressions deeper than 1/4 inch.
  3. Pill tie holes.
  4. Remove fins exceeding 1/8 inch in height.
- B. Rubbed finish:
1. Patch all tie holes and defects and remove all fins.
  2. Within one day of form removal, fill all bug holes, vet the surfaces and rub with carborundum brick until a uniform color and texture are produced; or
  3. Dampen surfaces, brush apply a grout slurry consisting of 1 part Portland cement to parts sand, and rub the surface vigorously with a stone. Remove all excess grout.
- C. Cementitious coating With the Engineer's approval, in lieu of the rubbed finish specified above, provide a two coat cement base waterproofing, sealing finish of Thoroseal and Thoroseal Plaster Mix as manufactured by Standard Dry Wall Products, Inc. or an approved equal.
1. Patch all tie holes and defects and remove all fins, and clean surface of all dirt, laitance, grease, form treatments, curing compounds, etc.
  2. Key coat: Apply key coat of Thoroseal at a rate of two (2) pounds per square yard by fiber brush. Mix material using one part of Acryl 60 to three parts clean water. Should material start to drag during application, damper surface with water. During

hot weather periods, dampen surfaces with water prior to application of key coat material. Key coat shall be allowed to cure for five (5) days before applying finish coat.

3. Apply a finish coat consisting of a four (4) to six (6) pound square yard application of Thoroseal Plaster Mix, using steel trowel or spray gun. Color shall be pearl gray unless otherwise noted. Mix dry material using one (1) part Acryl 60 to three (3) parts clean water. Firmly press the mix into all voids and level with a steel trowel. When surface is set so that it will not roll or lift, float it uniformly using a sponge float.

D. Float finish:

1. Begin Floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
2. Cut down all high spots and fill all low spots and float the slab to a uniform sandy texture.

E. Trowel finish:

1. Float finish as specified herein.
2. Power trowel to a smooth surface free of defects. c. After the surface has hardened sufficiently, hand trowel until a ringing sound is produced as the trowel is moved over the concrete surface.

F. Brush finish:

1. Float finish as specified herein.
2. Hand trowel to smooth surface free of defects.
3. Provide a scored texture by drawing a brush or fine broom across the surface.

G. Scratch surface:

1. Screed the surface to the proper elevations.
2. Roughen with rakes or stiff brushes..

H. Edge finish: Tool slab edges and joints with a 1/4 inch radius edging tool.

### 3.2 SURFACE REPAIR

A. Patching mortar:

1. Make a patching mortar consisting of 1 part Portland cement to 2-1/2 parts sand by damp loose volume.
2. Mix the mortar using one part acrylic bonding admixture to two parts water.

B. Tie holes: Clean and dampen all tie holes and fill solidly with patching mortar.

C. Surface defects:

1. Remove all defective concrete down to sound solid concrete.
  2. Chip edges perpendicular to the concrete surface or slightly undercut, allowing no feather edges.
  3. Dampen surfaces to be patched.
  4. Patch defects by filling solidly with repair mortar.
- D. Allow the Engineer to inspect the work before placing the patching mortar.
- E. Repair defective areas greater than 1 square foot or deeper than inches as directed by the Engineer using materials approved by the Engineer at no additional expense to the Owner.

**END OF SECTION**



# **SECTION 03370 CONCRETE CURING**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Initial and final curing of horizontal and vertical concrete surfaces.

### **1.2 RELATED SECTIONS**

- A. Section 03100 - Concrete Formwork.
- B. Section 03300 - Cast in Place Concrete.
- C. Section 03370 - Concrete Curing.

### **1.3 UNIT PRICE - MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 REFERENCES**

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.
- C. ACI 308 - Standard Practice for Curing Concrete.
- D. ASTM C171 - Sheet Materials for Curing Concrete.
- E. ASTM C309 - Liquid Membrane Forming Compounds for Curing Concrete.
- F. ASTM D2103 - Polyethylene Film and Sheeting

### **1.5 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide data indicating description of Products to be supplied, and color.

### **1.6 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.

- B. Manufacturer's Instructions: Indicate special procedures required to apply Products specified.
- C. Certificates: Certify that products meet or exceed specified requirements.

### **1.7 QUALITY ASSURANCE**

- A. Perform work in accordance with ACI 301, ACI 302, and ACI 308.

### **1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver curing materials in Manufacturer's packaging, including application instructions. Protect products from damage due to the elements and construction activity.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Curing Compounds
  - 1. On all vertical and formed surfaces, construction joints, basin slabs, surfaces to receive applied coatings or finishes, and other surfaces except as otherwise indicated or specified, use a non-residual, non-staining curing compound conforming to ASTM C309 Type 1 and 1D.
  - 2. On building floor slabs not otherwise receiving an applied coating or finish and on other flat surfaces as indicated on the Drawings, provide an acrylic co-polymer curing and sealing compound conforming to ASTM C309, Type 1. Product shall be non-yellowing, and shall contain a minimum 20% solids. Maximum unit moisture loss shall conform to ASTM C156 and shall not exceed 0.40kg/sq. m in 72 hours.
- B. Absorptive mats conforming to ASTM C171. Mats shall be either cotton fabric or burlap, minimum 8 oz per square yard.
- C. Waterproof paper shall conform to ASTM C171 and shall be treated to prevent separation during handling and placing.
- D. Polyethylene film shall conform to ASTM C171. Film shall be minimum 6 mil thick and clear.

## **PART 3 EXECUTION**

### **3.1 CURING**

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures and mechanical injury.
- B. Continuously cure concrete for a period of not less than 7 days after placement.

1. When seven day cylinder breaks indicate, in the opinion of the Engineer, the possibility of low strength concrete, Provide additional curing as per the request of the Engineer.
  2. When temperatures during the curing period fall below 40 degrees F, provide additional curing time as directed by the Engineer.
- C. Unless otherwise directed by the Engineer, cure concrete not in contact with forms in accordance with one of the following procedures:
1. Pending or sprinkling: Keep entire concrete surface wet by continuously sprinkling or by allowing water to pond, covering all surfaces.
  2. Wet burlap: Thoroughly wet and cover all concrete surfaces with wet burlap mats as soon as the concrete has set sufficiently to avoid marring the surface.
    - a. Keep the burlap continuously wet during the curing period.
  3. Curing blankets: Thoroughly wet concrete surfaces to be cured and cover with curing blankets as soon as the concrete has set sufficiently to avoid marring the surface.
    - a. Weight the blankets down to maintain close contact with the concrete surface.
    - b. Use sheets of waterproof kraft paper with the joints between sheets taped continuously; or
    - c. Use sheets of 4 mil or thicker polyethylene with the joints between sheets continuously taped.
  4. Wet sand: Apply a layer of sand over the entire surface and keep it continuously wet,
  5. Curing compound: Apply curing compound immediately after completion of the finish on unformed surfaces and within two hours after removal of forms on formed surfaces.
    - a. Spray the entire surface with two coats of liquid curing compound, applying the second coat in the direction of 90 degrees to the first coat.
    - b. Apply compound in accordance with the manufacturer's instructions to cover the surface with a uniform film which will seal thoroughly.
- D. Hot weather: When necessary, provide wind breaks, shading, fog spraying, sprinkling, pending or wet covering with a light colored material applying as quickly as concrete hardening and finishing operations will allow.

**END OF SECTION**





# **SECTION 03600 NON-SHRINK GROUT**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- A. Non-shrink grout for structural grouting, equipment bases, etc. as indicated and needed for a complete and proper installation.

### **1.2 RELATED SECTIONS**

- A. Section 03100 - Concrete Formwork.
- B. Section 03300 - Cast in Place Concrete.
- C. Section 03370 - Concrete Curing.

### **1.3 UNIT PRICE - MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

### **1.5 SUBMITTALS**

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 120 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section;
  - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

### **1.6 PRODUCT HANDLING**

- A. Prevent damage to or contamination of non-shrinking grouting materials during delivery, handling and storage.

- B. Deliver grout to site in polyethylene lined paper bags, not larger than one cubic foot in capacity.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Non-shrink grout:
  - 1. Provide non-metallic, non-shrink grout.
  - 2. Grout shall evidence no shrinkage when tested in the plastic state, in accordance with ASTM C827, or in the hardened state, in accordance with ASTM CRD588,
  - 3. Initial setting shall not occur in less than 60 minutes.
  - 4. Compressive strength in 24 hours shall not be less than 3000 psi, when tested in accordance with ASTM C109.
  - 5. Acceptable products: U.S. Grout Corporation's Five Star Grout; Sonneborn's Sonogrout; W.R. Bonsai Company's Type A Construction Grout; or equal.
- B. Water: Potable grade.
- C. Gravel: Comply with ASTM C33 for coarse aggregate graded so that 90% passes 3/8" sieve and 90% is retained by No. 4 sieve.

### **2.2 MIXES**

- A. Less than 2" clearance or for difficult grouting locations mix shall consist of grout material and water.
- B. Greater than 2" clearance where coarse aggregate will not obstruct free passage, extend grout by adding 1/2 pound of gravel to one pound grout material, except where prohibited by manufacturer's recommendations.
- C. Use the minimum amount of water necessary to produce a flowable grout without causing segregation or bleeding.

### **2.3 MIXING**

- A. Mix non-shrink grouting material and water in a mechanical mixing for no less than 3 minutes, unless otherwise approved by the Engineer.
- B. Mix as close to work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials,
- C. Retempering of grout will not be permitted.

## **PART 3 EXECUTION**

### **3.1 FORMWORK**

- A. Build leakproof forms that are strong and securely anchored and shored to withstand grout pressures.
- B. Provide ample clearance between formwork and the area to be grouted to permit proper placement of grout.

### **3.2 SURFACE PREPARATION**

- A. Remove all defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
- C. Remove foreign materials from all steel surfaces in contact with grout.
- D. Align, level and maintain final positioning of all components to be grouted.
- E. Take special precautions during extreme weather conditions according to the manufacturer's written instructions.
- F. Saturate all concrete surfaces with clean water; remove excess water and leave none standing.

### **3.3 PLACING**

- A. Place non-shrink material quickly and continuously by the most practical means permissible: pouring, pumping or under gravity pressure.
- B. Apply grout from one side only to avoid entrapping air.
- C. Final installation shall be thoroughly compacted and free from air pockets.
- D. Do not vibrate the placed grout mixture, or allow it to be placed if the area is being vibrated by nearby equipment.
- E. Do not remove leveling shims for at least 48 hours after grout has been placed.
- F. After shims have been removed, fill voids with plain cement-sand grout.

**3.4 CURING**

- A. Cure grout for 3 days after placing by keeping wet and covering with curing paper or by another approved method.

**END OF SECTION**

# **SECTION 05990 MISCELLANEOUS METALS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. The work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install all miscellaneous metal work, as indicated, specified, or as needed to provide a complete and proper installation.

### **1.2 RELATED SECTIONS**

- A. Section 05520 – Component Aluminum Handrails.
- B. Section 09900 - Painting

### **1.3 UNIT PRICE - MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 REFERENCES**

- A. AISC - Code of Standard Practice - Manual of Steel Construction - Allowable Stress Design (ASD).
- B. AISC - Section 10 - Architecturally Exposed Structural Steel.
- C. ASTM A36/A36M - Structural Steel.
- D. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- E. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- F. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- G. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- H. ASTM A242/A242M - High-Strength Low-Alloy Structural Steel.
- I. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- J. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- K. ASTM A449 - Quenched and Tempered Steel Bolts and Studs.

- L. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
- M. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- N. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- O. ASTM A502 - Steel Structural Rivets.
- P. ASTM A514/A514M - High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
- Q. ASTM A529/A529M - Structural Steel With 42 KSI (290 MPa) Minimum Yield Point (1/2 in. (12.7 mm) Maximum Thickness).
- R. ASTM A563 - Carbon and Alloy Steel Nuts.
- S. ASTM A568/A568M - General Requirements for Steel, Carbon and High-Strength Low-Alloy Hot-Rolled Sheet and Cold-Rolled Sheet.
- T. ASTM A572/A572M - High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.
- U. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination.
- V. AWS D1.1 - Structural Welding Code.
- W. FM - Roof Assembly Classifications.
- X. SSPC (Steel Structures Painting Council) - Painting Manual.
- Y. UL - Fire Resistance Directory.
- Z. Warnock Hersey - Certification Listings.

**1.5 SUBMITTALS FOR REVIEW**

- A. Submit complete shop drawings and product data in accordance with the requirements of Section 01300.
- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section.
    - a. Provide listing of all items to be provided and include type and location.
  - 2. Manufacturer's specifications and other data needed to demonstrate compliance with the specified requirements.
  - 3. Shop drawings shall show size of components, materials of construction, connection to other components and anchorage.

C. Samples shall be submitted at the Engineer's request.

**1.6 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.

**1.7 SUBMITTALS AT PROJECT CLOSEOUT**

- A. Section 01700 - Contract Closeout: 01730 - Operation and Maintenance Data: 01740 - Warranties and Bonds: Procedures for submittals.

**1.8 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

**1.9 PRODUCT HANDLING**

- A. All aluminum pipe and elbows shall be packed and shipped in individual plastic film to protect the anodized finish.
- B. All aluminum pipe and elbows shall be stored out of contact with ground and concrete.

**PART 2 PRODUCTS**

**2.1 GENERAL**

- A. Finished and machined faces shall be true to line and level.
- B. Welding shall conform to applicable requirements of:
  - 1. Steel products: American Welding Society Standard D1.1.
  - 2. Aluminum alloy products: Recommended practices as published in "Welding Aluminum" by the American Welding Society.

C. Unless otherwise specified, materials shall conform to the following:

Structural Steel	See Structural Drawings
Welded and Seamless Steel Pipe	ASTM A53
Steel Tubing	ASTM A501
Gray Iron Castings	ASTM A48, Class 30
Galvanizing, General	ASTM A123
Galvanizing, Hardware	ASTM A153

Galvanizing, Assemblies	ASTM A386
Aluminum (Extruded Shapes)	6063 T5 (Alum alloy)
Aluminum (Extruded Pipe)	6063 T6 (Aluminum alloy) or 6105 T6 (Aluminum alloy)
Aluminum Bars and Shapes (Structural)	6061 T6 (Alum alloy)
Bolts and Nuts	ASTM A307
Stainless Steel Bolts, Fasteners	AISI Type 304
Stainless Steel Plate and Sheet, Wire	AISI Type 316
Welding Rods for Steel	AWS Spec. for Arc Welding

- D. Workmanship and finish shall be equal to the best practices of modern shops for the respective work.
1. Exposed surfaces shall have smooth finish and sharp, well defined lines and arises.
  2. Sections shall be well formed to shape and size with sharp lines and angles.
  3. Curved work shall be sprung evenly to curves.
  4. Metal work shall be countersunk properly to receive hardware and provided with the proper bevels and clearance.
  5. Cutting shall be done by shearing, sawing or flame cutting; if flame cut, the metal shall be ground back to smooth sound material.
  6. Holes for bolts and screws shall be drilled.
  7. Conceal fastenings where practicable.

## 2.2 STEEL AND IRON SHAPES

- A. Provide standard, well finished, structural shapes of commercial grade bar stock.
1. Structural steel shall conform to the requirements of the Structural Drawings.
  2. Rolled shapes shall conform to dimensions and weights of Regular Series Shapes of AISC.
- B. Pipe shall be Schedule 40, unless otherwise indicated.

## 2.3 ALUMINUM SHAPES

- A. Provide extruded shapes of 6063-T5 alloy unless another alloy is better suited for the intended purpose.
- B. Furnish structural shapes conforming to dimensions and weights of the standard structural shapes of the Aluminum Association of 6061-T6.

## 2.4 ANCHOR BOLTS AND MISCELLANEOUS FASTENINGS

- A. General:
1. Provide as indicated, or as necessary for securing work in place, and anchoring equipment in place.



2. Sizes and spacing of anchor bolts not indicated shall be as required for the intended purpose.
- B. Provide anchor bolts, expansion anchors, epoxy adhesive anchors, nuts, washers and other fasteners of the materials indicated below unless otherwise indicated on the drawings.
1. Fastening structural steel shapes and plates to each other - ASTM A325 bolts.
  2. Anchoring structural steel to concrete - ASTM A307 anchor bolts.
  3. Fastening or anchoring stainless steel or aluminum to any material - Type 316 stainless steel.
  4. Anchoring processor mechanical equipment regardless of material to concrete - Type 316 stainless steel.
  5. Anchoring or fastening any materials which will be submerged in water or wastewater - Type 316 stainless steel.
  6. Any anchors or fasteners in contact with potable water - stainless steel.
  7. Anchoring wood or timber in non-submerged application - hot dipped galvanized.
  8. Other fasteners and anchor bolts not otherwise specified - Type 316 stainless steel
- C. Expansion anchors:
1. Use stud type with one piece wrap around expansion sleeve.
  2. Provide complete unit manufactured from 316 series stainless steel.
  3. Acceptable products: Phillips "wedge-Anchors", Ramset "Trubolt Stud Anchors"; or Hilti "Kwik-Bolt".
  4. Do not use expansion anchors in masonry.
- D. Epoxy adhesive anchors:
1. Provide injected epoxy adhesive anchors, consisting of screen tube and anchor rod.
  2. Anchor rod and nut to be Series 316 stainless steel.
  3. Acceptable products: Hilti "HIT" or equal.
  4. Use in masonry and where otherwise indicated.

## 2.5 INSERTS AND SLEEVES

- A. Provide as required and needed for support of piping, equipment and apparatus, or where passages through walls, floors, etc. are required.
- B. Bite and material shall be as indicated, or as approved by the Engineer.

## 2.6 UNISTRUT CHANNELS

- A. Channels shall be accurately and carefully extruded to size from aluminum, except as noted otherwise.
- B. Channels embedded in concrete shall be Type 304 stainless steel.

- C. Provide a continuous slot with in-turned clamping ridges on one side of channel.
- D. Fittings to be stainless steel or aluminum.
- E. Unless otherwise indicated on the drawings, channels to be 1-5/8" x 1-5/8" x .105" thick.
- F. Provide end caps on channels.
- G. Nuts, pipe hangers, clamps, etc. shall be units specifically intended and manufactured for use with "Unistrut" channels.
- H. All nuts, bolts, caps and clamps shall be stainless steel.
- I. Provide flexible elastomer material, "Uni-cushion" or equal, between all pipe clamps or hangers and PVC, copper or stainless steel pipe.

## 2.7 ACCESS RUNGS/MANHOLE STEPS

- A. Use aluminum steps.
- B. Provide steps having non-skid top surfaces, safety slope at each end, minimum width of 10" and not less than 5" projection from wall.
- C. Aluminum steps shall support 1000 pound load at center with no deformation, coat embedded ends with bituminous paint.

## 2.8 FLOOR ACCESS DOORS AND HATCHES

- A. Unless otherwise specified on the Drawings or elsewhere in these specifications, access Doors and Hatches shall meet the following minimum requirements:
  1. Provide ¼" thick, one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor.
  2. Furnish ¼" thick aluminum diamond plate door leaf(s), reinforced to withstand a live load of 300 pounds per square foot.
  3. Door(s) shall open to 90° and automatically lock with stainless steel hold open arms with aluminum release handles.
  4. All hardware including hinges and fastening hardware shall be stainless steel.
  5. Unit shall have a snap lock, flush with top surface, having removable handle.
  6. Provide 1½" drainage coupling in channel frame where indicated.
  7. Standard mill finish shall be provided on all aluminum surfaces, except for frames to be embedded in concrete. Frames to be embedded in concrete shall have a bituminous coating factory applied to the exterior of all frame surfaces that may come into contact with concrete.
- B. Size and type of access door shall be as indicated on the Drawings.

- C. Acceptable manufacturers: Halliday Products, Inc., Orlando Florida; The Bilco Company, Inc., New Haven, Connecticut; or equal.

## 2.9 ALUMINUM FLOOR GRATING

### A. General:

1. Provide aluminum I-bar (NAAMM P-19-4) grating manufactured in compliance with the standards established by the National Association of Architectural Metal Manufacturers.
2. Design grating depth in accordance with the following criteria:
  - a. Uniform load - 150 pounds per square foot.
  - b. Deflection - Less than 1/4" at the above load.
  - c. Minimum depth - 1-1/4" or as otherwise shown on the drawings.
3. Provide adequate support at openings in grating and where grating span changes direction for grating system to meet specified load requirements.
  - a. Fabricate supports from aluminum structural shapes.
4. Secure each panel with four Fasteners which do not extend above walking surface of the grating.
5. Coat all surfaces to be in contact with concrete with bituminous coating.
6. Provide grating and frame with mill finish.
7. Referenced product is Type IB I-Bar grating as manufactured by IKG Industries and is named to establish a standard of quality. Equal products by Ohio Gratings, or other manufacturers are acceptable.

### B. Grating:

1. Fabricate I-Bar grating using 1/4" thick I-bars spaced on 1-3/16" centers.
2. Provide cross bars locked at right angles to bearing bars spaced at no more than 4" on center.
3. Band all grating panel ends and openings where three or more bearing bars are cut.
  - a. Provide banding bar 1/8" minimum thickness times grating depth.
4. Unless indicated otherwise on the drawings, provide striated surface on bearing bars for I-Bar grating.

### C. Frames:

1. Provide aluminum bearing frames specifically designed to fit the openings shown and the grating provided.
2. Provide frames with continuous anchor groove or welded anchors.
3. Miter, weld and grind smooth all corners.

## 2.10 STAIR NOSINGS

### A. General:

1. Provide on each stair tread, at all interior and exterior concrete stairways.
2. Length shall be equal to stair width minus four inches.

## B. Interior Stairways:

1. Provide units consisting of a homogeneous epoxy abrasive formulation formed and cured upon an extruded aluminum base in five 1/4' deep rows separated by a raised aluminum section.
2. Provide 3/4" deep integrally extruded anchors.
3. Color selection shall be made by the Engineer.
4. Protect nosings with factory applied heavy duty polyethylene, moisture-proof, cloth tape.
5. Furnish the following types as manufactured by American Abrasive Metals Company, or equal.
  - a. Type 232A for cast-in-place concrete stairs.

## C. Exterior Stairways:

1. Provide cast aluminum abrasive metal safety treads, three inches wide with steel wing anchors and stainless steel or brass bolts.
2. Exposed wearing surface to have not less than 2 ounces per square foot of #16 to 124 size non-slip granules embedded in the top metal surface.
3. Pattern of finished abrasive surface shall be "hatched".
4. Furnish Style A as manufactured by American Abrasive Metals Company, or equal.

**2.11 SHIP LADDER, ALTERNATING TREAD TYPE**

A. Provide alternating tread type at 68 degrees from horizontal as manufactured by Lapeyre Stair, Harahan, LA or approved equal.

B. Manufacture stair units so that the only field assembly required is gluing the rubber strip to the central stringer.

## C. Construction:

1. Provide cast aluminum treads, landings and mounting feet.
  - a. Shield metal arc weld to a single extruded box-like stringer.
2. The tread castings shall have integrally cast handrail support arms which are precision machined and welded to continuous aluminum handrails.
3. Provide cast pedestrian surfaces with skid resistant surfaces.
4. Provide upturned integrally cast skid barriers on all treads.
5. Equally space all risers to within 3/16" for adjacent risers and to within 3/8" for any two non-adjacent risers on a stair.
6. The handrails shall be contoured for body guidance and underarm support and shall have inclined hand side portions for free sliding of the hands unimpeded by the handrail supports.
  - a. Handrails to be 1-1/2" x 1/8" tubular aluminum.
7. Provide a cast aluminum foot divider as an integral part of the landing and as a support for a rubber bumper strip which shall be provided for field gluing to the central stringer.

## D. Materials:

1. Landings, treads and mounting feet: Aluminum Alloy F356F.
2. Central Stringer: Aluminum Alloy 6063-T52.
3. Handrails: Aluminum Alloy 6063-T4.

## E. Finish:

1. Provide clean, natural finish with no mill markings.

**2.12 HANDRAILS**

- A. All handrails shall be component aluminum handrails in accordance with Section 05520 – Component Aluminum Handrails, unless otherwise specified.

**2.13 SHOP PAINTING**

- A. Clean and prime all ferrous metal surfaces with primer compatible with finish coats specified in Section 09900: Painting.

**2.14 DOCK BUMPERS**

- A. Furnish and install extra-length laminated rubber dock bumpers as manufactured by Durable Corporation, Model No(s) B612-123-A, or equal. Resilient rubber material of bumpers shall be rubberized-fabric truck tires cut to uniform size pads 6" x 12". Pads punched to receive 3/4" supporting rods.
- B. All dock bumpers must be 6" thick (projection from dock), and closed with two 3" x 3" x 1/4" structural angles under approximately 1,500 lbs of pressure. The angles are welded to 3/4" rods at one end and closed with threaded rod and nut at the other end.
- C. The anchor leg of angle extends a minimum of 3" beyond the rubber surface at either end and contains three 13/16" anchor bolt holes as required.
- D. The finish for exposed metal parts shall be hot dipped galvanized.
- E. Provide dock bumpers as indicated on the Drawings.

**PART 3 EXECUTION****3.1 GENERAL**

- A. Install all items, plumb, square and level as intended and as shown on the Drawings.

**3.2 MASONRY ANCHORS**

- A. Drill hole in accordance with manufacturer's guidelines.
- B. Inject epoxy using manufacturer's approved injection equipment.
- C. Allow three hours cure time before putting a load on the anchors.
- D. Do not install if temperature is to be below 41 degrees F during time required for cure.

**3.3 UNISTRUT CHANNELS**

- A. Mount on wall, floor or ceiling using stainless steel expansion or masonry anchors or embed in concrete where indicated.
- B. Install channels level and plumb.

**3.4 ACCESS RUNGS**

- A. Cast in walls of pits, manholes, etc. as the wall is placed.

**3.5 FLOOR DOORS AND HATCHES**

- A. Set level, top flush with finish slab elevation, orient door opening as indicated, or as approved by the Engineer.
- B. Protect surface from concrete splatters during placement of concrete.
- C. Clean surface of any concrete stains, etc.

**3.6 ALUMINUM FLOOR GRATING**

- A. Set frames level blocking and bracing as necessary to prevent distortion during placing of concrete.
- B. Place grating panels in position and fasten at each corner.
- C. Clean surface of concrete, mud and other materials.

**3.7 STAIR NOSINGS**

- A. Insert nosings into freshly placed concrete, tapping top surface of nosing to insure full embedment of anchors into the concrete.
- B. Remove protective taps as recommended by nosing manufacturer.

**3.8 UNISTRUT CHANNELS**

- A. Fabricate from "Unistrut" channel sections and fittings as indicated.
- B. Make all cuts square and free from burrs.
- C. Attach securely to support structure with stainless steel wedge anchors.

**END OF SECTION**





# **SECTION 07920 CAULKING AND SEALANTS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Caulking and sealing of all joints as shown on the Drawings or otherwise indicated to provide a barrier against the passage of moisture and air.

### **1.2 REFERENCES**

- A. ASTM C790 - Use of Latex Sealing Compounds.
- B. ASTM C804 - Use of Solvent-Release Type Sealants.
- C. ASTM C834 - Latex Sealing Compounds.
- D. ASTM C919 - Use of Sealants in Acoustical Applications.
- E. ASTM C920 - Elastomeric Joint Sealants.
- F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All costs for work performed under this Section shall be included in the lump sum price as bid for the project, or in other unit costs as applicable.

### **1.4 SUBMITTALS**

- A. Refer to Section 01300 – Submittals and Progress Schedules for shop drawing submittal requirements.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations and color availability.
- C. Samples: When requested by Engineer, submit two appropriately sized samples illustrating sealant colors for selection.

- D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation and perimeter conditions requiring special attention.

## 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Compatibility: Provide joint sealants , joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.
- B. Joint sealant (For General Exterior Use):
  - 1. Provide two component, polyurethane based elastomeric sealant complying with the provisions of Federal Specification TT-S-00227E, Type II (Non-Sag), Class A, and ASTM C 920. Approved Products:
    - a. Sikaflex – 2c, manufactured by Sika Corporation;
    - b. Approved equal.
- C. Sealant for use in masonry building joints:
  - 1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; Uses T, M, and O, with the additional capability to withstand 50 percent movement in both extension and compression for a total of 100 percent movement.
- D. Sealant for Use in Interior Joints in Ceramic Tile and Other Hard Surfaces in Kitchens and Toilet Rooms and Around Plumbing Fixtures:
  - 1. Single-component, mildew-resistant silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide.
- E. Sealant for Interior Use at Perimeters of Door and Window Frames:
  - 1. Latex sealant, single-component, nonsag, mildew-resistant, paintable, acrylic-emulsion sealant complying with ASTM C 834.

## F. Accessory Materials:

1. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer to suit application; compatible with joint forming materials.
2. Joint Primer/Sealer: Provide type recommended by sealant manufacturer to suit application.
3. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer.
4. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application and prevent sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint.
5. Joint Backing: Provide closed cell polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam or neoprene foam rod as recommended by sealant manufacturer for compatibility with sealant material.
6. Tooling Agent: Provide agent recommended by sealant manufacturer to insure contact of material with inner joint faces.
7. Divider Strips: Synthetic rubber or closed cell synthetic foam not less than 1/6" thick and full depth of sealant; approved by manufacturers of dissimilar materials as being compatible with each other.

**2.2 COLOR**

- A. Color shall be selected by the Engineer from the manufacturer's standard colors that are normally available.

**PART 3 EXECUTION****3.1 EXAMINATION**

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

**3.2 PREPARATION**

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions.
- D. Protect elements surrounding the work of this section from damage or disfiguration.

**3.3 INSTALLATION**

- A. Install sealant or caulking in accordance with manufacturer's written instructions, unless more stringent requirements are shown or specified elsewhere.
- B. Joint surfaces shall be primed or sealed as recommended by the sealant manufacturer.
- C. Install bond breaker where joint backing is not used.
- D. Install sealant in uniform, continuous ribbons free of air pockets, foreign embedded matter, ridges, and sags.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges. Do not apply when temperatures are below 40 deg. F.
- F. Tool joints as recommended by sealant manufacturer.
- G. Install sealants to depths shown, or if not shown, to depth recommended by the sealant manufacturer.
- H. Cure sealants in accordance with manufacturers instructions.
- I. Comply with ASTM C1193.

**3.4 CLEANING**

- A. Clean work under provisions of 01700.
- B. Clean adjacent soiled surfaces.

**END OF SECTION**

# SECTION 09900 PAINTING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

- A. Prepare, paint and finish the exterior and interior surfaces indicated or specified, and as needed for a complete and proper installation.
  - 1. Surfaces not specifically excluded shall be painted, whether new or old.
  - 2. Concealed ferrous metal surfaces.
- B. Unless otherwise indicated, painting of following surfaces will not be required.
  - 1. Concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
  - 2. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper (except piping), bronze and similar non-ferrous materials.
  - 3. Moving parts of operating units, mechanical or electrical parts such as valve operators, linkages, sensing devices, and motor shafts.
  - 4. Exterior concrete surfaces, including interior walls of treatment tanks.
  - 5. PVC piping systems.
  - 6. Instruments, control panels, chlorinators, etc. Having factory applied finishes.
  - 7. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates.
- C. Related Work: Priming or priming and finishing of certain surfaces may be specified to be factory performed or installer performed under pertinent other Sections.

### 1.2 RELATED SECTIONS

- A. Section 15190 - Mechanical Identification.
- B. Section 16195 - Electrical Identification.

### 1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project.

## 1.4 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.
- C. AWWA (American Water Works Association) - C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
- D. AWWA (American Water Works Association) - D102 - Painting Steel Water Storage Tanks.
- E. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.
- F. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.
- G. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.
- H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

## 1.5 DEFINITIONS

- A. "Paint", as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers and other applied materials whether used as prime, intermediate or finish coats.

## 1.6 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittal.
- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section;
  - 2. Manufacturer's specifications and other data needed to demonstrate compliance with the specified requirements.
- C. Subcontractor qualifications.
- D. Color chips: Provide for each type of finish coat required.
- E. Schedule:
  - 1. Submit schedule listing of all surfaces to be painted, manufacturer's name, generic type, trade or brand name, system for each surface including number of coats and total dry film thickness.

2. Secure Engineer's approval of schedule, in writing, prior to ordering any materials.

**1.7 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturer's Application Instructions: Indicate any special application procedures required.

**1.8 SUBMITTALS AT PROJECT CLOSEOUT**

- A. Section 01700 - Contract Closeout: 01740 - Warranties and Bonds: Procedures for submittals.

**1.9 QUALITY ASSURANCE**

- A. Reference manufacturer is the Tnemec Company, Inc. and is named to establish standards of quality. Equal products of other manufacturers may be provided for the project upon approval by the Engineer.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Paint coordination:
  1. Provide finish coats which are compatible with the prime coats actually used.
  2. Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
  3. Upon request, furnish information on the characteristics of the specific finish materials to assure that compatible prime coats are used.
  4. Provide barrier coats over noncompatible primers, or remove the primer and reprime as required.
  5. Notify the Engineer in writing of anticipated problems in using the specified coating systems over prime coatings supplied under other Sections.
- D. Subcontractor qualifications:
  1. Paint subcontractor to have a minimum of three years practical experience and successful history in the application of specified products.
  2. Furnish a list of references and job completions.
- E. Technical Services:
  1. Provide a manufacturer's representative to visit the site during initial work to verify compliance with these specifications, to assure coatings are properly applied, and the proper equipment is being used.

2. Provide a manufacturer's representative at completion of painting to verify painting was installed according to specifications.

### **1.10 PRODUCT HANDLING**

- A. Deliver all material to site in original, new, unopened containers, labeled and bearing manufacturer's name and stock number, product and brand name, contents by volume for major constituents, instructions for mixing and reducing, and application instruction.
- B. Provide adequate storage facilities designed exclusively for the purpose of paint storage and mixing.
- C. Facility area shall be located away from open flames, be well ventilated, and be capable of maintaining ambient storage temperature of no less than 45 degrees F.
- D. Paint, coatings, reducing agents, and other solvents must be stored in original containers until opened, If not resealable, then must be transferred to UL approved safety containers.
- E. Provide proper ventilation, personal protection and fire protection for storage and use of same. Comply with requirements set forth by Occupational Safety and Health Act for storage and use of painting materials and equipment.

### **1.11 EXTRA STOCK**

- A. Upon completion of the work of this Section, deliver to the Owner at least one gallon of each color, type, and gloss of paint used in the Work, tightly sealing each container and clearly labeling with contents and location where used.

## **PART 2 PRODUCTS**

### **2.1 PAINT MATERIALS**

- A. Source of all paint material is subject to approval by the Engineer.
- B. All paint material which will be in contact with potable water shall have the approval of the S.C. Department of Health and Environmental Control and shall be NSF approved for such use.
- C. All paint materials to be used in any one system shall be the products of one manufacturer.
- D. Where products are proposed other than those specified by name and number in the Painting schedule, provide under the product data submittal required by Article 1.6 of this Section a new painting schedule compiled in the same format used for the Painting Schedule included in this Section.



- E. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits.

**2.2 COLOR SCHEDULE**

- A. The Engineer will prepare a color schedule for guidance in the painting, based upon the color chips as supplied by the Contractor.

**2.3 APPLICATION EQUIPMENT**

- A. Use only such equipment as is recommended by the paint manufacturer.

**2.4 OTHER MATERIALS**

- A. Provide other materials not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

**PART 3 EXECUTION**

**3.1 SURFACE CONDITIONS**

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

**3.2 ENVIRONMENTAL CONDITIONS**

- A. Do not work under unfavorable weather conditions.
  - 1. Air and surface temperatures must be above 45 degrees F, dewpoint not within 5 degrees of surface temperature, and relative humidity less than 85%.

**3.3 SURFACE PREPARATION**

- A. General:
  - 1. Prepare and clean all surfaces to be painted in a workmanlike manner with the objective of obtaining a smooth, clean and dry surface.
    - a. Surface shall be free from cracks, ridges, nail holes, etc.
    - b. Surface shall be free of oil, grease, dirt, dust, rust, scale, etc.
  - 2. Schedule cleaning and painting so that dust and other contaminants from cleaning operations will not fall onto newly painted surfaces.
  - 3. Remove or mask items not to be painted.
    - a. Contractor shall be responsible for any damage due to overspray.
- B. Ferrous metals:

1. Remove all rust, dust, scale and other foreign substances.
2. Give welded joints special attention, removing all welding flux, slag and weld spatter.

C. Non-ferrous metals:

1. Solvent clean prior to shop or field application of pretreatment and/or primer.

D. Concrete:

1. Clean surface free of curing compounds, oil, grease, dirt, chalk or previously applied coatings.
2. Acid etch all surfaces (except those to receive acrylic, latex or bituminous sealings or coatings) using a muriatic acid solution, 1 part acid to 2 parts water.
  - a. When bubbling ceases, wash down with fresh water and scrub using stiff brush, rinse well with water.
  - b. If surface still has acid, neutralize by washing down with 1-2% ammonia solution.
3. Surface to be dry unless otherwise indicated in printed instructions from the paint manufacturer.

E. Masonry surfaces:

1. Remove all oil, grease, dirt, dust and foreign substances.

F. Wood surfaces:

1. Clean until free from dirt, oil, and other foreign substances.
2. Smooth finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.

G. Factory finished components:

1. Solvent clean prior to field application of pretreatment and/or primer.

### **3.4 MATERIALS PREPARATION**

A. General:

1. Mix and prepare paint materials in strict accordance with the manufacturer's recommendations as approved by the Engineer.
2. When materials are not in use, store in tightly covered containers.
3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.

- B. Stripping:
  - 1. Stir materials before application, producing a mixture of uniform density.
  - 2. Do not stir into the material any film which may form on the surface, but remove the film and, if necessary, strain the material before using.

### 3.5 PAINT APPLICATION

- A. General:
  - 1. Touch-up shop applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application (see subsection 3.7 of this Section).
  - 2. Slightly vary the color of succeeding coats.
    - a. Do not apply additional coats until the completed coat has been inspected and approved.
    - b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
  - 3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five feet.
  - 4. On removable panels and hinged panels, paint the back sides to match the exposed sides.
  - 5. Items with factory finishes shall be field painted to the color chosen by the Engineer per the requirements contained herein unless otherwise approved in writing by the Engineer.
    - a. Items with a factory finish shall be stored so as to prevent damage to the finish.
- B. Drying:
  - 1. Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.
- C. Brush or roller applications:
  - 1. Brush or roll coats onto the surface in an even film.
  - 2. Cloudiness, spotting, holidays, laps, brush or roller marks, runs, sags, ropiness and other surface imperfections will not be acceptable.
  - 3. Confine brush or roller applications to concrete, masonry, wood and gypsum wallboard.
- D. Spray application:
  - 1. Employ spray application on all metal surfaces, equipment, pipe, valves, gates, metal framework and similar surfaces where hand work would be inferior.
  - 2. Where spray application is used apply each coat to the specified dry film thickness.
  - 3. Do not double back with spray equipment to build up film thickness of two coats in one pass.

### 3.6 PAINTING SCHEDULE

A. Provide one prime coat (shop or field) and two finish coats, unless otherwise specified, in accordance with the following:

B. Systems:

1. In the schedules following, the type of paint system is identified by symbol in parenthesis immediately behind the manufacturer's name:

- a. Alkyd (A)
- b. Acrylic (AC)
- c. Acrylic Latex (ACL)
- d. High Build Urethane (HBU)
- e. High Solids Epoxy (HSE)
- f. High Build Coal Tar Solution (HBCT)
- g. Alkyd Gloss (AG)
- h. Epoxy Polyamide (EP)
- i. Silicone (S)
- j. Silicone Aluminum (SA)
- k. Modified epoxy (ME)

C. Ferrous metal submerged in wastewater and non-potable water:

System: Tnemec (HSE)

Surface preparation: SSPC-SP10 Near-White Blast Cleaning

Shop coat: 1 Omnithane Primer, 3.0 dry mils

2nd coat: 66-Color Hi-Build Epoxoline, 4.0 dry mils

3rd coat: 104-Color H.S. Epoxy, 8.0 dry mils

Type finish: Semi-gloss

D. Ferrous metal submerged in potable water:

System: Tnemec (EP)

Surface preparation: SSPC-SP10 Near White Blast Cleaning

Shop coat: 1 Omnithane Primer @ 3.0 dry mils

2nd coat: 20-1255 Pota-Pox Beige @ 4.0 dry mils

3rd coat: 20-15BL Pota-Pox Finish @ 4.0 dry mils

E. Ferrous metal, including C.I. or D.I. pipe, non-immersion:

System: Tnemec (HBU)

Surface preparation: SSPC-SP6 Commercial Blast Cleaning (fabrications) or SSPC-SP3 Power Tool Cleaning

Shop coat: Manufacturer Standard Primer, 2:0 dry mils

2nd coat: 530 Omnithane, 3.0 dry mils

3rd coat: 73-Color Endura-Shield III, 4.0 dry mils

Type finish: Semi-gloss

F. Overhead metal decking and joists:

System: Tnemec (A)

Surface preparation: Surfaces must be dry, clean and free of oil, grease and other contaminants. Allow concrete to cure 28 days.

Shop coat: 10 Tnemec Primer, 2.0 dry mils

1st coat: 115 Ini-Bond DF, 3.5 dry mils

Type finish: Semi-gloss

G. High heat coating: Use on items of equipment, piping, etc. subject to high temperatures such as blowers, blower piping, hydraulic power units and hydraulic piping, etc. where indicated.

System: Tnemec (SA)

Surface preparation: SSPC-SP10 Near-White Blast Cleaning

1st coat: 39-661 Silicone Aluminum 1.0 dry mils

2nd coat: 39-661 Silicone Aluminum 1.0 dry mils

H. Concrete block, interior:

System: Tnemec (HSE)

1st coat: 130 Envirofill 80 sq. ft./gal (fill all voids)

2nd coat: 104-Color H.S. Epoxy, 200 sq.ft./gal.

3rd coat: 104-Color H.S. Epoxy, 200 sq.ft./gal.

Type finish: Semi-gloss

I. Concrete block, exterior:

System: Tnemec (ME)

1st coat: 181 W.B. Tneme-Crete, 80 sq. ft./gal.

2nd coat: 181 W.B. Tneme-Crete, 80 sq. ft./gal.

Type finish: Flat, sand

J. Brick masonry:

System: Tnemec (S)

Surface preparation: Surface must be dry, clean and free of loose mortar.

1st coat: Prime A Pell 200

K. Concrete walls and ceilings, interior:

System: Tnemec (HSE)

Surface preparation: Surface to be clean and dry.

1st coat: 104-Color H.S. Epoxy, 219 sq.ft./gal.

2nd coat: 104-Color H.S. Epoxy, 219 sq.ft./gal.

Type finish: Semi-gloss

L. Concrete walls, exterior, where indicated on the plans:

System: Tnemec (ME)  
Surface preparation: Surface shall be clean and dry.  
One coat: 181 W.B. Tneme-Crete, 90 sq.ft./gal.  
Type finish: Flat.

M. Concrete, exterior, below grade, where indicated on the plans:

Surface preparation: Surface must be clean and dry.  
1st coat: 46-465 H.B. Tnemecol, 94 sq.ft./gal  
2nd coat: 46-465 H.B. Tnemecol, 94 sq.ft./gal.

N. Cast iron or ductile iron pipe, bituminous coated:

1. Provide one prime coat as specified below and finish with two coats of appropriate metal finish as specified in paragraphs 3.6C or 3.6D above.
2. Tnemec Series 1 Omnithane Primer, 3.0 dry mils.

O. Non-ferrous metals:

1. Treat with manufacturer's recommended wash primer or pretreatment.
2. Provide finish coats as specified in paragraphs 3.6C or 3.6D above.

P. Wood surfaces, interior and exterior:

System: Tnemec (AG)  
Surface preparation: Surface shall be clean and dry.  
1st coat: 10-99W Tnemec Primer, 2.5 dry mils  
2nd coat: 2H-Color Tneme-Gloss, 1.5 dry mils  
3rd coat: 2H-Color Tneme-Gloss, 1.5 dry mils  
Type finish: Gloss

Q. Insulated pipe:

System: Tnemec (ACL)  
Surface preparation: Surface shall be clean and dry.  
1st coat: 1029 Enduratone, 320 sq.ft./gal.  
2nd coat: 1029 Enduratone, 320 sq.ft./gal.  
Type finish: semi-gloss sheen.

R. Galvanized surfaces:

System: Tnemec  
Surface preparation: SSPC-SP1 Solvent Cleaning  
One coat: 66-1211 Epoxoline Primer, 3.0 dry mils  
Finish with final coat as specified in paragraph 3.6C or 3.6D above

- S. Concrete floors, where indicated on the plans (Light traffic):

System: Tnemec (EP)  
 Surface preparation: ICRI CSP3.  
 1st coat: 205 Terra-Tread FC, 200 sq.ft./gal.  
 2nd coat: 205 Terra-Tread FC, 200 sq.ft./gal.  
 3rd coat: 291 CRU, 330 sq.ft./gal.

- T. Concrete floors, anti-skid, where indicated on the plans (Heavy traffic):

System: Tnemec (EP)  
 Surface preparation: ICRI CSP4.  
 1st coat: 222 Deco-Tread, 1/8 inch - double broadcast  
 2nd coat: 284 Deco-Clear 200 sq.ft./gal.

- U. Concrete flumes, launders, channels, etc. immersion or intermediate contact with water, where indicated on the plans:

System: Tnemec (HSE)  
 Surface preparation: SSPC-SP13, ICRI CSP5  
 1st coat: 218 MotarClad applied to fill all holes, voids and surface irregularities and to provide a smooth and even finish. This coating shall also skim the entire surface of the concrete.  
 2nd coat: 435 Perma-Glaze, 15.0 dry mils  
 3rd coat: 435 Perma-Glaze, 15.0 dry mils  
 4th coat: 291 CRU, 2.0 – 3.0 dry mils

- V. Gypsum wallboard:

System: Tnemec (HSE)  
 Surface preparation: Surface must be dry, clean and free of contaminants.  
 1st coat: 151 Elasto-Grip, 273 sq.ft./gal.  
 2nd coat: 104-Color H.S. Epoxy, 219 sq.ft./gal.  
 Type finish: Semi-gloss

- W. PVC piping systems:

System: Tnemec (EP)  
 Surface preparation: Surface must be dry and clean.  
 1st coat: 66 Hi-Build Epoxoline, 4.0 dry mils

### 3.7 TOUCH-UP OF APPLIED COATINGS

- A. Prior to any touch-up, the area is to be SP-3 brush cleaned.

- B. Shop applied coatings:

1. Shop applied coatings with specified primer, as listed in Part 3:6 above, shall be touched up with the same listed primer before any topcoat(s) are applied.

2. Shop applied coatings with manufacturer's standard paint for non-immersion shall be touched up with a compatible barrier coating, Tnemec Series 530 Omnithane.
  - a. Manufacturer shall notify the Engineer in writing if the manufacturer's standard paint is unable to receive the specified top coat(s) or if problems are anticipated due to incompatible coating Systems.

C. Field applied coatings:

1. After cleaning, apply specified primer followed by specified finish coats.

**3.8 COLOR CODING, PIPING**

- A. Paint all exposed piping according to the color schedule selected by the Engineer.
- B. Install self-adhesive piping markers complying with Section 15190 – Mechanical Identification.

**3.9 INSPECTION AND ACCEPTANCE**

- A. Examination of overall appearance and measurement of dry film thickness.
- B. Correct defects and/or deficiencies to satisfaction of the Engineer.

**3.10 CLEAN-UP**

- A. Upon completion, painting contractor shall clean-up and remove from site all surplus materials, tools, appliances, empty cans, cartons, and rubbish resulting from painting work. Site shall be left in neat, orderly condition.
- B. Remove all protective drop cloths and masking from surfaces not being painted. Provide touch-up around same areas as directed by the Engineer.
- C. Remove all misplaced paint splatters or drippings resulting from this work.

**END OF SECTION**



# **SECTION 10430 SIGNAGE**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section includes all labor and materials to furnish and install signs as specified herein.

### **1.2 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment will be made for work under this section. The payment for all work under this section shall be included in the lump sum amount given in the BID.

### **1.3 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittal.
- B. Product data - Submit the Following:
  - 1. Materials list of items proposed to be provided under this Section;
    - a. Provide listing of all items to be provided and include type and location.
  - 2. Manufacturer's specifications and other data needed to demonstrate compliance with the specified requirements.
  - 3. Shop drawings showing details of equipment including details of construction, dimension, description of materials, etc.

### **1.4 SUBMITTALS FOR INFORMATION**

- A. Section 01300 - Submittals: Procedures for submittals.

### **1.5 SUBMITTALS AT PROJECT CLOSEOUT**

- A. Section 01700 - Contract Closeout, Operation and Maintenance Data, Warranties and Bonds, Procedures for submittals.

### **1.6 QUALITY ASSURANCE**

- A. Provide the latest standard product of a manufacturer regularly engaged in the production of this type equipment.

**PART 2 PRODUCTS**

**2.1 GENERAL**

A. Manufacturers: Manufacturers are named below to establish standards of quality. Equal products by other manufacturers may be provided upon approval by the Engineer. All products shall be by the same manufacturer. Referenced manufacturers:

- 1. Seton Inc., Branford, Connecticut. Phone: 1-800-571-2596.

**2.2 DOOR SIGNS**

A. Exit and Emergency Contact Signs:

- 1. Provide exit signs on the inside face of exterior doors.
- 2. Provide emergency contact sign outside of exterior doors.
- 2. Signs shall comply with OSHA regulations. Unless otherwise indicated, signs shall be manufactured of pressure sensitive vinyl material.
- 3. Description: Unless otherwise indicated, provide 10" x 7" sign having red letters on a white background.
- 4. Provide illuminated signs where indicated on the Electrical Drawings.

**2.3 DANGER SIGNS & LABELS**

A. Provide DANGER signs where indicated on the Drawings or specified herein or where otherwise required.

- 1. Provide signs, measuring 14" x 10", manufactured of 60 mil thick press polished high performance Tedlar coated vinyl plastic. Provide signs that are resistant to fade from sunlight. Signs shall have rounded corners.
- 2. Signs shall comply with OSHA standards and have a main heading that reads: DANGER, in white letters on a red background with a black border. Signs shall have a subtitle with black letters on a white background.
- 3. Mount signs using stainless steel screws.
- 4. Sign Schedule:

LOCATION	SIGN SUBTITLE	QUANTITY OF SIGNS PER LOCATION
Pump Station Wet Well	Confined Space – Enter Tank By Permit Only	1*

\*Install on access hatches.

B. Provide DANGER adhesive labels where indicated on the Drawings or specified herein or where otherwise required.

1. Provide vinyl adhesive labels measuring 3.5" x 5". Provide labels that are resistant to fade from sunlight. .
2. Labels shall comply with OSHA standards and have a main heading that reads: DANGER, in white letters on a red background with a black border. Signs shall have a subtitle with black letters on a white background.
3. Label Schedule:

LOCATION	SIGN SUBTITLE	QUANTITY OF SIGNS PER LOCATIONS
Electrical Panels (All 480V or Higher)	High Voltage	1 @ Each Panel

**2.4 CAUTION SIGNS**

- A. Provide caution signs as indicated on the Drawings, specified herein, or where otherwise required.
  1. Provide signs, measuring 14" x 10" or 5" x 7" as indicated in the schedule below. Signs shall be manufactured of 60 mil thick press polished high performance Tedlar coated vinyl plastic or aluminum as noted in the schedule below. Provide signs that are resistant to fade from sunlight. Signs shall have rounded corners.
  2. Signs shall comply with OSHA standards and have a main heading that reads: CAUTION, in yellow letters on a black background with a yellow border. Signs shall have a subtitle with black letters on a yellow background.
  3. Mount signs using stainless steel hardware.
  4. Sign Schedule:

LOCATION	Size (in.)	SIGN SUBTITLE	Material	QUANTITY OF SIGNS PER LOCATION
Non-Potable Water Sources	5" x 7"	Non-Potable Water – Do Not Drink	Aluminum	1*

\*Provide one sign at each non-potable water tap (yard hydrants, hose bibs, etc.).

**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance.

**3.2 INSTALLATION**

- A. If no adequate means of sign support is available, Contractor shall fabricate sign support from unistrut channel and fittings.

**END OF SECTION**

# **SECTION 11306 SUBMERSIBLE PUMPS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section covers the work necessary to furnish, install and place into operation the submersible pump systems specified herein.

### **1.2 RELATED SECTIONS**

- A. Section 01700 – Contract Closeout
- B. Section 02751 – Plant Piping, Valves, and Appurtenances.
  - 1. Section 11400 - Control Panels and Systems
  - 2. Section 11510 - Electric Motors.
  - 3. Division 16 - Electrical.
  - 4. Section 16483 - Variable Frequency Controllers

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment will be made for work performed under this section. The cost of all work covered by this section shall be included in the lump sum price as bid for the project.

### **1.4 SUBMITTALS FOR REVIEW**

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data – Submit the Following:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Manufacturer's specifications and other data needed to provide compliance with the specified requirements.
  - 3. Shop drawings showing plan, elevation and sectional views, materials of construction and other details.
- C. Manufacturer's Instructions: Indicate special procedures required to install Products specified.
- D. Certificates: Certify that products meet or exceed specified requirements.

1. Submit a guaranteed performance curve, signed by a representative of the pump manufacturing company.

**1.5 SUBMITTALS AT PROJECT CLOSEOUT**

- A. Section 01700 - Contract Closeout: 01730 - Operation and Maintenance Data: 01740 - Warranties and Bonds: Procedures for submittals.
- B. Provide paper copies of O & M Manuals as specified in Section 01700.

**1.6 REGULATORY REQUIREMENTS**

- A. Conform to applicable codes for materials and installation of the Work of this section.

**PART 2 PRODUCTS**

**2.1 REFERENCED MANUFACTURERS**

- A. The referenced manufacturers are listed in this section only to establish the standards of quality for all equipment being furnished. Equal products of other manufacturers may be accepted with written approval from the Engineer. The listing of any manufacturer as a reference in no way diminishes the manufacturer’s responsibility to strictly comply with these specifications.
- B. Pumps
  1. ABS Pumps
  2. Or Pre-Approved Equal

**2.2 PUMPS AND PUMP MOTORS**

Pump Schedules:

**Pump Station “B”**

Liquid Pumped:	Sanitary Sewer
Design Point:	300 GPM @ 94’ TDH
Maximum Motor Power:	20 HP
Maximum Motor Speed #:	1800 RPM
Motor Power Supply:	230-Volt, 3 phase

- A. Furnish four (4) submersible non-clog wastewater pumps, two (2) pumps per Pump Station . Each pump shall be equipped with a 20.1 HP, 1780 rpm submersible electric motor connected for operation on 230 V, 3 phase, 60 Hz. wire service. The pumps shall be ABS model XFP100G-CB1 or pre-approved equal. Pump(s) operating at higher speeds than specified are not considered equal. Each unit shall be rated for a discharge as indicated above.

- C. The pumps shall be designed to pump raw, unscreened sewage, stormwater, and other fibrous pumpage without damage during operation. The pump shall be capable of passing a three inch diameter sphere without damage to the pump or clogging of the pump. The pumps shall be designed such that the pump shaft horsepower (BHP) shall not exceed the motor rated horsepower throughout the entire operating range of the pump performance curve.
  
- C. Each pump shall be supplied with automatic coupling system for easy removal of a pump for repair or replacement. The coupling system shall include an upper guide rail bracket, guide bar(s) or rail(s), sliding guide rail bracket and a mating cast iron guide rail discharge base elbow fitted with a standard ANSI 125# flange sized as shown on the drawings. The discharge base shall be permanently mounted in the wet well and connected to the discharge piping as shown on the drawings. The pumps shall be automatically and firmly connected to the discharge connection, guided by Type 316 stainless steel guide bars or rails extending from the top of the station to the discharge connection. Intermediate guide rail support brackets shall be provided on deep wet wells. The sliding guide rail bracket shall be a separate part of the pumping unit capable of being attached to standard ANSI or DIN pump flanges so that the base is interchangeable with other pumps and not limited to a specific model or manufacturer of pump. Non-standard flange dimensions shall not be considered acceptable. Positive sealing of the pump to the discharge elbow shall be accomplished without the need for a service technician to enter the wet well to replace any parts. If a gasket is used for the seal, it shall be a field replaceable Nitrile rubber gasket mechanically held in place between the pump and the sliding guide bracket.
  
- D. Each pump shall be fitted and equipped with a sufficient length of Type 316 stainless steel lifting chain or cable suitable for a rated working load of at least 50% greater than the pump unit weight. There shall be no need for personnel to enter the wet well.
  
- E. Major pump components shall be of gray cast iron, ASTM A48, Class 35B with smooth surfaces, free of blowholes, or other irregularities. All exposed nuts or bolts shall be AISI type 316 stainless steel. All metal surfaces coming into contact with the pumpage other than the stainless steel shall be protected by a factory applied spray coating of alkyd primer with a chlorinated rubber paint finish on the exterior of the pump.
  - 1. The impeller shall be of gray cast iron, Class 35B, dynamically balanced, semi-open single vane non-clogging design having a long throughlet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge, and other matter found in wastewater. Whenever possible a full vane impeller shall be used for maximum hydraulic efficiency. The impeller shall be retained by means of an allen head bolt, and shall be capable of passing a three-inch diameter solid sphere. The impeller shall be coated with an alkyd resin primer.
  - 2. Pump volute shall be gray cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. The minimum discharge size shall be as specified in drawings.

The discharge flange shall permit attachment to standard ANSI or DIN flanges and appurtenances.

- F. The rotating assembly (impeller, shaft, and rotor) shall be dynamically balanced such that undue vibration or other unsatisfactory characteristics will not result when the pump is in operation at any speed greater than 40% of the pump's rated speed under any hydraulic condition.
- G. Each pump shall be furnished with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an oil reservoir that hydrodynamically lubricates the lapped seal faces at a consistent rate. The lower, primary seal unit, located between the pump and oil chamber shall contain one stationary and one positively driven ring made up of silicon carbide or tungsten carbide. The upper, secondary seal unit, located between the oil chamber and the motor housing shall contain one stationary carbon, silicon carbide, or tungsten carbide ring and one positively driven rotating Cr-steel, silicon carbide, or tungsten carbide seal ring. Each seal interface shall be held in place by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to prevent overfilling and to provide oil expansion capacity. The drain and inspection plug shall be readily accessible from the outside and shall be provided with a positive anti leak seal. The seal system shall not rely on pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.
- H. Seal failure moisture sensors shall be provided in the seal oil chamber and the stator chamber for detecting the presence of water. In addition, for motors larger than 33 HP, moisture sensors shall also be provided in the electrical connection chamber for detecting the presence of water. Each probe shall be connected to a solid-state module in the pump control panel. The solid-state devices shall send a low voltage, low amperage signal to the probes. If water enters the monitored chambers, the probe shall signal the solid-state device and energize an alarm to stop the motor and activate an alarm.
- I. The pump and motor shaft shall be the same unit. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be AISI type 420 stainless steel. The shaft shall be adequately designed to meet the maximum torque required at any startup condition or operating point in the system. The maximum deflection of the shaft shall not exceed 0.002 inches at the lower seal. Each shaft shall have a polished finish and have accurately machined shoulders to accommodate bearings, seals and impeller.
- J. The pump shaft shall rotate on permanently greased lubricated upper and lower bearings. The upper bearing shall be a single deep groove ball or cylindrical roller bearing. The lower bearing shall be either one double row bearing or two single row bearings mounted in tandem. The lower bearing shall be a heavy duty angular contact bearing to compensate for axial thrust and radial forces and minimize shaft deflection. The calculated B10 bearing life rating shall be 100,000 hours minimum. The motor shall be supplied with bi-metallic sensors to monitor the temperature of



the upper and lower bearings. These sensors shall be connected to the control panel such that when they open, the motor will stop and activate an alarm.

- K. The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type inverter duty rated per NEMA standard MG-1 (part 31) to withstand 1600 volts peak and rise times of >0.1  $\mu$ sec, and adequately sized so that the pump is non-overloading throughout the entire pump performance curve. The motor shall be capable of operating with variable speed drives under full load to 50% speed completely unsubmerged without overheating or causing any damage to the motor. The stator windings and stator leads shall be insulated with moisture resistant Class H insulation rated for 356°F (180°C). The stator shall be dipped and baked three times in Class H varnish and shall be head shrink fitted into the stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 104°F (40°C) and capable of up to 12 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 260°F (125°C) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These terminal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel such that when they open, the motor will stop and activate an alarm. The motor and pump shall be designed and assembled by the same manufacturer.
1. The combined service factor (combined effect of voltage, frequency, and specific gravity) shall be a minimum of 1.3. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 104°F (40°C) ambient and with a temperature rise not to exceed 176°F (80°C). A performance chart shall be provided showing curves for torque, current, power factor, input/output KW, and efficiency. This chart shall also include data on starting and no-load characteristics.
  2. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the pump control panel or junction box without the need for splicing. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
  3. The motor horsepower shall be adequate such that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out. At a minimum, motor shall be designed to allow pump operation at 40% of maximum pump speed.
- L. The cooling jacket shall surround the stator housing, thereby providing heat dissipation of the motor. The cooling jacket shall be of a non-clog design and shall not require the use of clean out ports. A circulating impeller attached to the main motor shaft shall provide the necessary circulation of non-toxic propylene glycol solution through the cooling jacket. The coolant shall be pumped through an integrated heat exchanger in the base of the motor, where excess heat is transferred to the process liquid.
- M. Electrical work and controls shall be installed in accordance with the shop drawings and the manufacturer's recommendations for the equipment supplied. All electrical

work shall be subject to the provisions of the NEC and shall be installed by licensed personnel.

### **2.3 PUMP CONTROL PANEL**

- A. The pump control panel as shown on the drawings and as specified herein shall be capable of the operation of two submersible pumps as specified. The control panel and all components shall be in accordance with Section 11400 - Control Panels and Systems.
- B. Enclosure:
  - 1. NEMA 12 Type 316 Stainless Steel, either freestanding or with Stainless Steel Floor Stand Kit, door stop, hinged exterior door, easy open latches (no tools required) and padlocking provisions. Panel shall be provided with a hinged interior panel. All breakers, lights, pushbuttons, switches, and accessories shall be visible and operable without opening the hinged interior panel.
- C. Functional Requirements:

The control panel shall be an automatic pump control center suitable for 230V, 60 Hz., single-phase power. The panel shall provide the following features in addition to that required by Section 11400 - Control Panels and Systems.

- 1. Main Power Circuit Breaker/Disconnect Switch.
- 2. Surge suppressor – Eaton Model PTX-160 transient surge protector with indication lights and integral disconnect switch with 160 kA rating or equal.
- 3. Control power breaker.
- 4. Separate breaker for each pump starter.
- 5. Variable speed drives (VFD) for phase conversion and pump speed control. See section 16483 for specifications on the VFDs. Provide VFD with 3% AC line reactors and 3% DC link reactors.
- 6. Hand-Off-Auto switches for each pump.
- 7. Run, Auto and Stop indication lights for each pump.
- 8. Manual-Automatic speed selection switch for each pump.
- 9. Manual and Auto speed indication lights for each pump.
- 10. Manual speed potentiometer for each pump.
- 11. Indication lights and reset buttons for motor failure of each pump on over temperature, seal failure, pump breaker trip, and VFD fail. Failure lights shall be latching until the reset button is pressed.
- 12. Flashing alarm light, horn, for remote mounting and auxiliary contacts with test button, horn silence button and reset button on panel.
- 13. Auxiliary dry contacts shall be provided on all alarm indications for external use including, but not limited to, pump run, pump overtemperature, pump seal failure, high level alarm, and power failure. Contacts shall be provided with both normally open and normally closed logic.
- 14. Solid-state control relays for moisture probes in each pump.
- 15. Terminal for thermal switches for over-temperature of each phase of the motor windings, upper bearings, and lower bearings for each pump.

16. Running hour meters for each pump.
17. Lead pump selection switch with indicating lights.
18. Oversized control power transformer large enough to serve the breakers in the panel.
19. Control power-indicating light.
20. Ultrasonic level sensor with 4-20 mA signal.
21. Programmable logic controller with uninterruptible power supply and sufficient number of discrete input, analog input, discrete output, and analog output modules, relays, timers, switches, and other equipment as necessary to operate the pumps and other instrumentation according to the control scheme and monitor all functions associated with the operation of the facility as described herein and as shown on the drawings
22. Ten (10) ea. Mercury switch type wet well floats with cable long enough to reach the control panel/junction box without splicing. Five (5) floats per Pump Station.
23. Panel shall meet all requirements of Section 11400 - Control Panels and Systems.
24. GFCI Convenience outlet.
25. Internally mounted space heater with thermostat.
26. Lead Pump selector switch for use with float control.
27. Float Logic/PLC control selection switch with indicating light

**D. General Control Scheme Requirements:**

1. PLC/Ultrasonic Level Sensor Pump Operation Scheme:
  - a. The PLC shall be the primary control mechanism for turning the pumps on and off based on level readings taken from the ultrasonic level sensor.
  - b. The PLC/Ultrasonic Level Sensor control option shall be selected using the Float Logic/PLC selection switch.
  - c. The normal operation will allow the pumps in each wet well to alternate between the lead and lag, pump position upon each successive wet well cycle. The lead pump shall be started upon reaching a level designated as "Lead Pump On." The lag pump shall be started if the wet well level continues to rise to a level designated as "Lag Pump On." The lag pump will stop when the wet well reaches the "Lag Pump Off" elevation. The lead pump will stop when the wet well reaches the "Lead Pump Off" elevation.
  - d. The normal operation will allow the pumps to alternate the lead and lag position upon each successive wet well cycle provided both pumps are in the automatic position. If either pumps H-O-A switch is in the off position, then that pump is considered out of service and shall be removed from the alternation sequence.
  - e. Under normal operation, the lead and lag pumps will vary their speed according to the level in the wet well with adjustable tuning parameters.
  - f. When the wet well is below a level designated "Low Level Alarm," there shall be an alarm indicating low water level and both pumps shall be locked out from operation in either the hand or automatic position until the wet well level reaches at least the "Lead Pump On" level which shall unlock the pumps to operate. The low level alarm will not reset until the reset button is pressed.

- g. An alarm condition will occur on a high level in the wet well at a predetermined elevation designated "High Level Alarm," which will cause the control mechanism to switch from PLC control to float control. Both pumps will run and operate at the speed set by the potentiometer until the wet well level drops to the pump off level. The pumps will then continue to operate based on float control until the Back-up Mode reset button is pushed.
  - h. The high level alarm will initiate the flashing light and horn remotely mounted on the exterior of the building.
  - i. In the HAND position, the selected pump speed shall be controlled by the speed potentiometer and shall operate independently from the alternation sequence. The pump will not run if the wet well is below the low-level alarm elevation.
  - j. Upon resuming power after a power failure, the pumps will be provided with an automatic staggered restart of the equipment with a field adjustable time from 1 second to 99 seconds.
  - k. In the event the PLC and/or ultrasonic level sensor fail to operate, 120V controls shall be in place to control the on and off operation of the pump based on the float control logic.
2. Float Control Pump Operation Scheme:
- a. The floats shall be the secondary control mechanism for turning the pumps on and off. The UPS will be by-passed when controlling the wet well level with floats.
  - b. The Float control option shall be selected using the Float Logic/PLC selection switch. Additionally, the float controls shall be automatically initiated if the level in the wet well reaches the high level alarm or if there is a failure with the PLC and/or ultrasonic level sensor.
  - c. The float control operation will allow the pumps in the wet well to alternate between the lead and lag position upon each successive wet well cycle using the float logic alternator controllers. The lead pump shall be started upon reaching the float level designated as "Lead Pump On." The lag pump shall be started if the wet well level continues to rise to the float level designated as "Lag Pump On." Both pumps will stop when the wet well reaches the "Pump Off" float elevation. If the wet well rises beyond the "Pump Off" level but the "Pump Off" float does not energize, then the lead pump will start once the wet well reaches the "Lag Pump On" float.
  - d. The float control operation will allow the pumps to alternate the lead and lag pump position upon each successive wet well cycle provided both pumps are in the automatic position. The lead pump selection switch shall be used to designate the lead pump if the alternating sequence is not used. If either of the pump H-O-A switches are in the off position, then that pump is considered out of service and shall be removed from the alternation sequence.
  - e. Under float control operation, the pump speed will be determined by the speed potentiometer switches.
  - f. When the wet well is below a level designated "Low Level Alarm," there shall be an alarm indicating low water level and both pumps shall be locked out from operation in either the hand or automatic position until the wet well level reaches at least the "Lead Pump On" level which shall unlock the pumps to operate. The low level alarm will not reset until the reset button is pressed.
  - g. An alarm condition will occur on a high level in the wet well at a predetermined elevation designated "High Level Alarm." Both pumps will run and operate at

- the speed set by the potentiometer until the wet well level drops to the pump off levels. The pumps will then continue to operate based on float control until the Back-up Mode reset button is pushed.
- h. The high level alarm will initiate the flashing light and horn remotely mounted on the exterior of the building.
  - i. In the HAND position, the selected pump speed shall be controlled by the speed potentiometer and shall operate independently from the alternation sequence. The pump will not run if the wet well is below the low-level alarm elevation.
  - j. Upon resuming power after a power failure, the pumps will be provided with an automatic staggered restart of the equipment with a field adjustable time from 1 second to 99 seconds.

## 2.4 ACCESSORIES AND SPARE PARTS

- A. The following list of spare parts shall be supplied to the Owner. All spare parts shall be clearly labeled, properly protected and delivered in a sturdy wooden box(es) for long term storage by the Owner.
  - 1. One set of any specialty tools necessary for repair or maintenance of the pumping equipment.
  - 2. Two complete sets of upper and lower bearings.
  - 3. Two complete sets of upper and lower shaft seals.
  - 4. Two complete sets of all Nitrile O-rings and elastomer cable grommets required for one pump.
  - 5. One Impeller.
  - 6. Four Nitrile rubber discharge elbow gaskets (if applicable).
  - 7. One (1) spare pump identical to the pumps installed.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that the site conditions are as noted on the Drawings. Notify the Engineer of any irregularities.

### 3.2 PREPARATION

- A. Protect structures near the well site from damage.
- B. Contractor and his personnel shall be familiar with and abide by the applicable provisions of the Occupational Safety and Health Administration (OSHA) regulations at all times during construction.

### 3.3 INSTALLATION

- A. The pumping station shall be constructed so as to conform to all other applicable portions of other sections of these Specifications, Drawings, and the following:

- B. The Contractor shall install the pumps and other equipment in strict accordance with the manufacturer's instructions. After installation, pump alignments will be checked and corrected if necessary. Excessive vibration or noise will not be allowed.
  - 1. The completed installation shall be properly lubricated, checked, and the operating characteristics determined by the manufacturer's representative in the presence of the Engineer. Additionally, the amperage draw shall be checked at the design conditions for each pump unit. Upon inspection by the manufacturer's representative, a letter of certification shall be provided to the Engineer and the Owner stating that the equipment has been installed in accordance with the manufacturer's recommendations and contains the certified results from all manufacturer's field testing.
  - 2. All pump station piping shall be installed with braces, clamps, and supports furnished as required. All joints shall be perfectly watertight. Pipe shall be tested in accordance with the provisions of Section 02733. Any small piping, which is required, but is not shown in detail on the Drawings, shall be furnished and installed.
  
- C. Electrical wiring, motors and controls shall be installed and electrically connected in accordance with the shop drawings and the manufacturer's recommendations for the equipment supplied and as specified in Division 16. All electrical work shall be subject to the provisions of the NEC and shall be installed by licensed personnel.

**3.4 TOLERANCES**

- A. Pumping Station Structure shall be installed plumb and true to the lines and grades as established on the Drawings.

**3.5 PERFORMANCE TESTING**

- A. Notify the Engineer 48 hours prior to flow rate testing.
  
- B. Each pump shall be tested separately to verify that it delivers the required flow under actual field conditions. The pumps shall also be tested simultaneously to record the pumping capacity of all pumps operating in parallel. A copy of the test results shall be certified by the manufacturer's representative and provided to the Engineer along with the manufacturer's verification of installation.

**3.6 PROTECTION OF FINISHED WORK**

- A. Section 01700 - Contract Closeout: Protecting installed work.

**END OF SECTION**

# **SECTION 11307 TEMPORARY BYPASS PUMPING**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section covers the requirements for implementation of a temporary pumping system that will be installed for the purpose of diverting the existing flow around the work area for the duration of the project, as needed.

### **1.2 RELATED SECTIONS**

- A. Section 11306 - Wastewater Pumping Equipment

### **1.3 MEASUREMENT AND PAYMENT**

- A. No direct payment will be made for the work under this Section. All Costs for work performed under this Section shall be included in the lump sum price as bid for the project.

### **1.4 REQUIREMENTS FOR SUBMITTALS**

- A. Section 01300 – Submittals and Progress Schedule
- B. The Contractor shall prepare with the vendor a specific, detailed description of the proposed pumping system and submit it along with the vendor's references prior to commencing work on the project for approval.
- C. The Contractor shall submit to the Town and Engineer detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows. This plan must be specific to each of the sites, and completely including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.
- D. The plan for each site shall include but is not limited to details of the following:
  - 1. Staging areas for pumps;
  - 2. Sewer plugging method and types of plugs;
  - 3. Number, size, material, location and method of installation of suction piping;
  - 4. Number, size, material, method of installation and location of installation of discharge piping;
  - 5. Bypass pump sizes, capacity, number of each size to be on site and power requirements;

6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted);
7. Standby power generator size, location;
8. Downstream discharge plan;
9. Method of protecting discharge manholes or structures from erosion and damage;
10. Thrust and restraint block sizes and locations;
11. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;
12. Method of noise control for each pump and/or generator;
13. Any temporary pipe supports and anchoring required;
14. Design plans and computation for access to bypass pumping locations indicated on the drawings;
15. Calculations for selection of bypass pumping pipe size;
16. Schedule for installation of and maintenance of bypass pumping lines;
17. Plan indicating selection location of bypass pumping line locations.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Under this item the Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the existing flow around the work area for the duration of the project.
- B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the engineer that he specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five (5) references of projects of a similar size and complexity as this project performed by his firm within the past three years. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

### **2.2 EQUIPMENT**

- A. All pumps used shall be fully automatic self-priming units that do not require the use of footvalves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. Temporary electrical service to be supplied and paid by the contractor. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows. All pumps shall be self-priming pumps as manufactured by Godwin Pumps of America, Inc. or approved equal.
- B. The Contractor shall provide the necessary stop/start controls for each pump.
- C. The Contractor shall include one stand-by pump of each size to be maintained on site. Back-up pumps shall be on-line, isolated from the primary system by a valve.
- D. Discharge Piping - In order to prevent the accidental spillage of flows all discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no



circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the engineer. Allowable piping materials will be Steel Pipe or fused, high-density polyethylene pipe as manufactured by Phillips Driscopipe, Inc., **PolyBarb piping** or **approved** equal.

- E. Bypass pumping units must be provided with sound attenuating enclosures.
- F. If electric pumps are to be used for bypass pumping, the contractor shall supply a back-up power source or redundant diesel pumps as a back-up.

**2.3 DESIGN REQUIREMENTS**

- A. Bypass pumping systems shall have sufficient capacity to pump a peak flow of:

**Pump Station "B"**

Manhole #1

Liquid Pumped:	Sanitary Sewer
Design Point:	10 gpm at 83 feet TDH

Manhole #2

Liquid Pumped:	Sanitary Sewer
Design Point:	150 gpm at 83 feet TDH

Manhole #3

Liquid Pumped:	Sanitary Sewer
Design Point:	125 gpm at 83 feet TDH

- B. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping system will be required to be operated 24 hours per day.
- C. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
- D. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.
- E. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.

## 2.4 PERFORMANCE REQUIREMENTS

- A. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.
- B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
- C. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
- D. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding.
- E. The Contractor shall protect water resources wetlands and other natural resources.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that the site conditions are as noted on the Drawings. Notify the Engineer of any irregularities.

### 3.2 PREPARATION

- A. Precautions
  - 1. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the City and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.
  - 2. During all bypass pumping operation, the Contractor shall protect the Pumping Station and main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the Pumping Station and main and all local sewer lines caused by human or mechanical failure.

**3.3 INSTALLATION AND REMOVAL**

- A. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide adequate suction conduit.
- B. Plugging or blocking of sewage flows shall incorporate primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance or work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.
- C. When working inside manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible oxygen-deficient atmospheres, and confined spaces.
- D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the engineer, the Contractor shall remove all the piping, restore all property to pre-construction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the City.

**3.4 FIELD QUALITY CONTROL AND MAINTENANCE**

- A. Test:
  - 1. The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The engineer will be given 24 hours notice prior to testing.
- B. Inspection:
  - 1. Contractor shall inspect bypass pumping system as often as required to ensure that the system is working correctly.
- C. Maintenance Service:
  - 1. The Contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.
- D. Extra Materials:
  - 1. Spare parts for pumps and piping shall be kept on site as required.
  - 2. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

**3.5 PROTECTION OF FINISHED WORK**

- A. Section 01700 - Contract Closeout: Protecting installed work.

**END OF SECTION**

# **SECTION 11400 CONTROL PANELS AND SYSTEMS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section covers the general requirements for control panels and package control systems. The general requirements herein, together with the detailed requirements of the Equipment Specifications, establish the work necessary to furnish and install the package control systems. These requirements will apply to all control panels and systems unless specifically changed within the specific Equipment Specifications where the package control panel or system is specified.
- B. Major constituents of each system include, but are not limited to, all materials, equipment, and work required to implement a complete and operating system of instrumentation and controls for its associated equipment. The systems shall include primary elements for process variable measurements, analog display and control elements, and discrete display and control elements as noted hereinafter and in the associated Equipment Specifications.

### **1.2 RELATED SECTIONS**

- A. Equipment specifications DIVISION 11 contain detailed descriptions of the individual package control panels and systems which shall conform to the requirements specified herein. All control panels and systems shall conform to these general requirements.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate payment will be made for the work in this section. Payment for the work in this general section will be included as part of the payment for the equipment covered by the Specifications sections referenced herein where package control panels and systems are specified or required.

### **1.4 REFERENCES**

- A. NFPA 70 - National Electrical Code.
- B. NEMA ICS 1 - General Standards for Industrial Control Systems.
- C. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
- D. NEMA ICS 3 - Industrial Systems.
- E. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- F. NEMA ST 1 - Standard for Specialty Transformers (Except General Purpose Type.)

- G. Underwriters Laboratories - UL approval

**1.5 DEFINITION OF TERMS**

- A. Package Control System: Package control systems include all instrumentation and controls (including but not limited to circuit breakers, motor starters, gauges, transmitters, panels, process and manual switches, indicators, and controllers) furnished under all specification sections. Each package control system includes all instrumentation and controls furnished under a single section.

**1.6 RESPONSIBILITY FOR COMPLETE SYSTEM**

- A. The Contractor shall be ultimately responsible and shall provide for the supply, installation, including all interconnecting conduit and wire, certification, adjustment, and startup of complete, coordinated systems which shall reliably perform the specified functions.

**1.7 SUBMITTALS DURING CONSTRUCTION**

- A. In addition to the requirements in Section SUBMITTALS AND PROGRESS SCHEDULES in Division 1, GENERAL REQUIREMENTS, the following information shall be provided to the Engineer before any components are fabricated and/or integrated into assemblies or shipped to the site.
  - 1. Bill-of-Material catalog information, descriptive literature, wiring diagrams, and shop drawings for all components of the control system including spares, expendables and test equipment. Include all scale ranges, set points, etc.
  - 2. Catalog information on all electrical devices furnished with the system.
  - 3. Shop drawings and catalog material for all control panels and enclosures.
  - 4. Panel elementary diagrams of prewired panels. Diagrams shall include all control devices and all auxiliary devices such as relays, alarms, fuses, lights, fans, heaters, etc.
  - 5. Plumbing diagrams of preplumbed panels and interconnecting plumbing diagrams.
  - 6. Interconnection wiring diagrams which include numbered terminal designations which show external interfaces.
  - 7. Programmable Controller Submittals:
    - a. Fully documented ladder logic listings
    - b. Function listing for all function blocks not fully documented by the ladder logic listings
    - c. Cross-reference listing

**1.8 TESTS**

- A. Tests of the package control systems shall be in accordance with the individual equipment specifications.
- B. As a minimum, the testing shall include factory tests. Prior to shipment, all panels and panel assemblies shall be tested for proper operation at the Equipment Supplier's factory.

**1.9 ONSITE SUPERVISION AND TRAINING**

- A. Requirements for system startup assistance by engineering personnel and training of the Owner's personnel in the operation and maintenance of the systems shall be in accordance with the individual equipment specifications.

**1.10 DOCUMENTATION**

- A. Documentation of the package control systems shall be in accordance with the individual equipment specifications.
- B. As a minimum, the documentation shall include updated versions of all submittal information, assembly drawings, logic diagrams, and certifications of all panels and assemblies that they are in compliance with these specifications.

**PART 2 MATERIALS****2.1 FUNCTIONAL REQUIREMENTS**

- A. General:
  1. The equipment specifications along with the Process and Instrumentation Diagrams, if applicable, depict the minimum functional requirements of the control systems to be provided with the package systems. The Equipment Suppliers shall provide all additional instrumentation and controls necessary to provide a safe and operable system. The specific control systems proposed shall be subject to the approval of the Engineer, and shall be submitted in accordance with Section SUBMITTALS DURING CONSTRUCTION.
  2. All instrumentation, control and electrical components provided under this section shall be of industrial quality and in conformance with the Component Specifications in Section PROCESS INSTRUMENTATION AND CONTROL SYSTEM and Division 16, ELECTRICAL.
  3. Where materials of construction, mounting methods, unit ranges, scale ranges, set points, calibrations, etc., are not indicated, provide appropriate selection and document the selection in the submittals. Engineering units shall be used.
  4. For Wastewater pump station and similar hazardous locations, applications provide intrinsically safe wiring in control panels.
- B. Interconnecting Wiring: Prewire all electrical devices to either:
  1. The equipment control panel where the panel is supplied by the equipment manufacturer and mounted on or with the equipment; or
  2. Common well marked terminal junction boxes for each of the following types:
    - a. Power (208 volts or greater)
    - b. Control, discrete (120 volt)
    - c. Control, analog

- C. Equipment Specification Format: Each Equipment Specification provides detailed descriptions of the following:
  - 1. Panels: The tag number, material, NEMA rating, special requirements, and type (freestanding, surface mount, etc.) of panel(s) that shall be provided by the Equipment Supplier.
  - 2. Operator Controls and Indicators: The minimum required operator interfaces that shall be provided by the Equipment Supplier.
  - 3. External Interfaces: The minimum required interfaces between the package control system and other equipment.
  - 4. Functional Requirements: The minimum functional performance requirements for the control system which can include an abstract of the functions of any interlocks, interfaces, and alarm conditions.
  - 5. Power Requirements: The power requirements and interfaces with the power source of the control systems.
  - 6. Special Requirements: Any additional requirements unique to the individual control system. This would include special component requirements, tests, onsite supervision, training, and nonstandard interfaces .
  
- D. Tag Numbers

**2.2 SIGNAL CHARACTERISTICS**

- A. Analog signals shall be 4 to 20 mA dc and shall conform to the compatibility requirements of ISA Standard S50.1. Unless otherwise noted, circuits shall be Type 2, two-wire. Transmitters shall have a load resistance capability conforming to Class L. Input and output signals of all transmitters and receivers shall be fully isolated.
  
- B. Pulse frequency signals shall use dc pulses whose repetition rate is linearly proportional to the process variable over a 10:1 range. Pulses may be generated by contact closures or solid state switches. Power source shall be less than 30V dc.
  
- C. Discrete signals are two-state logic signals. Control and alarm signals shall utilize 120V ac sources. All alarm signals shall be normally open (open when de-energized), close to alarm isolated contacts rated for 5-ampere at 120V ac and 2-ampere at 30V dc continuous operation.

**2.3 ENVIRONMENTAL CONDITIONS**

- A. Equipment rated NEMA 1 or NEMA 12 shall be suitable for the following environmental conditions:  
  
Temperature: 40 to 105 degrees F  
Relative Humidity: 10 to 80 percent  
Classification: Nonhazardous



- B. Equipment rated NEMA 4X shall be suitable for the following environmental conditions:

Temperature: 40 to 105 degrees F

Relative Humidity: 10 to 100 percent

Atmosphere: Corrosive (Hydrogen Sulfide and salt spray)

Classification: Nonhazardous

## 2.4 CONTROL PANELS

- A. Panels shall be completely fabricated, instruments installed, plumbed, and wired in the Equipment Suppliers' factories, if possible. In the case of control panels being furnished by other than the supplier of the controlled equipment, the panels shall be fabricated by a firm having three years documented experience in control panel fabrication. All wiring and plumbing shall be completed and tested prior to shipment. All external connections shall be by way of numbered terminal blocks. All panels shall be constructed of components having the UL stamp of approval and unless specified otherwise the panel will bear the UL seal of approval for the as-built control panel.
- B. All connections for future functions shall be wired to numbered terminal blocks, grouped separately from the terminal blocks in use. Terminal blocks shall also be grouped to keep 120V ac circuits separate from the 24V dc circuits.
- C. Sufficient terminal blocks shall be provided to terminate all spare conductors. In addition, the greater of 15 percent or four unused spare terminals shall be provided.
- D. Panel Construction:
1. Panels shall be enclosures conforming to the requirements of the National Electrical Manufacturer's Association for the NEMA rating noted in the individual Equipment Specifications.
  2. Panel material shall be Type 316 stainless steel unless otherwise noted in the individual Equipment Specifications.
  3. In addition to the NEMA Standards, the panels shall conform to the following requirements:
    - a. Minimum metal thickness shall be 14 gauge.
    - b. All doors shall be rubber-gasketed with continuous hinge. For NEMA 1 and 12 panels, doors more than 36 inches high shall have 3-point latching mechanisms. All other doors shall have stainless steel quick-release clamps.
    - c. Wherever practical, enclosures shall be a manufactured item, Hoffman, H. F. Cox, or equal.
    - d. Panel cutouts for instruments and other devices (e.g., lights and switches) shall be cut, punched, or drilled and smoothly finished with rounded edges.
    - e. Panels shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel.
    - f. Where panels are mounted outside or in unheated areas, they shall be provided with thermostatically controlled heaters that will maintain their inside temperature above 40 degrees F.

- g. Provide a hand switch controlled internal 100-watt incandescent light for panels larger than 12 cubic feet in volume.
  - h. Unless otherwise noted, panels shall be constructed with front access only suitable for installation with side and back surfaces adjacent to and in contact with other surfaces.
- E. Control Panel Finish: All metallic external surfaces (excluding aluminum and stainless steel), shall be finished with an ANSI 61 gray polyester powder coating over phosphatized surface. Internal surfaces shall be painted with a white enamel.
- F. Control Panel Electrical:
- 1. General: All electrical work shall be in accordance with the applicable requirements of Division 16, ELECTRICAL.
  - 2. Power Distribution Within Panels:
    - a. Control Panels Without Motor Starters: Provide master circuit breaker and a circuit breaker on each individual circuit distributed from the panel. The circuit breakers shall be grouped on a single subpanel. Provide subpanel placement so that there is a clear view of and access to the breakers when the door is open. Circuit breakers shall be Heinemann Electric Co. Series AM; Airpax/North American Philips Controls Corp. Series 205; or equal. Branch circuit breakers shall be rated for 15-ampere at 250-volt.
    - b. Control Panels With Motor Starters: Control panels which have 3-phase power supplies and contain motor starters in addition to logic controls shall contain a main circuit breaker interlocked with the panel door and an interior swing-panel to provide dead front construction. Each motor starter shall be supplied with a separate circuit breaker. All logic controls will be provided with a separate circuit breaker. All logic controls, branch circuit breakers, overload reset switches, and other control circuit devices shall mount on or through the swing-panel. Control devices and indicating lights shall be mounted on the front access door. Circuit breakers shall be operable without opening the dead front panel. The swing-panel shall have a minimum swing of 145 degrees and shall have quarter-turn hand latches. Power system components shall be as follows:
      - i. Circuit breakers shall meet the requirements of UL and NEMA AB1. All breakers shall have a 25,000-ampere RMS symmetrical interrupting rating, minimum, at 480 volts unless otherwise indicated in the equipment Specifications. Main and branch circuit breakers, except motor branch circuit breakers, shall be molded case thermal magnetic. Provide a method for padlocking of motor branch circuit breakers in the OFF position. Motor branch circuit breakers for larger motors shall be thermal magnetic with adjustable magnetic trip units. Motor branch circuit breaker ratings shall be as recommended by the manufacturer for maximum motor protection. Tripping of breakers shall be indicated by operator handle position. Provide circuit breakers suitable for use with 75 degrees C wire at full NEC 75 degrees C ampacity.

- ii. Full voltage magnetic motor starters shall meet NEMA ICS 2, Class A, NEMA size 0 minimum. Unless otherwise specified, Motor starters shall include 3-pole ambient temperature compensated bimetallic thermal overload relays sized for the motor which it protects. Overload relays shall be field selectable for manual or automatic reset type with a manual reset button mounted on the panel door. Overload relays shall have an adjustable trip current setting to allow for the adjustment from 85% to 115% of the trip current rating.
  - iii. All motor control shall be 120V ac (except intrinsically safe circuits where applicable). Provide a control power transformer that has sufficient capacity to serve the connected load including 200VA for the duplex outlet plus 100VA (minimum) and limits voltage variation to 15 percent during contact pickup. Fuse one side of the secondary winding and ground the other side. Provide primary winding fuses in all ungrounded conductors.
  - iv. Provide a power monitoring relay to protect 3-phase equipment against single phasing, phase unbalance and phase reversal. Provide separate, isolated contact outputs to stop all motors and to activate an alarm light in the event of an abnormal condition. Power monitoring relay shall have 10,000-volt transient voltage protection and shall be Furnace Class 47, or equal.
  - v. Power distribution blocks shall be used to parallel feed line side of all branch circuit protective devices. "Leap frogging" of power conductors shall not be acceptable.
3. Wiring: Wiring within panels, consoles, and assemblies shall meet the following requirements:
- a. Wires for ac circuits shall be 600-volt, Type MTW stranded copper and shall be sized for the current to be carried, but not smaller than No. 16 AWG.
  - b. Wires for analog signal circuits shall be 300-volt stranded copper and shall be twisted shielded pairs not smaller than No. 18 AWG.
  - c. Wires for other dc circuits shall be 300-volt, Type MTW stranded copper and shall not be smaller than No. 18 AWG.
  - d. All analog and other dc circuits shall be separated at least 6 inches from any ac power and control wiring.
  - e. All wiring shall be enclosed in either sheet metal raceways or plastic wiring ducts. Wiring ducts shall be complete with rounded ends, covers and wire protectors.
  - f. Wiring shall be numbered and tagged at each termination. Wire tags shall be snap-on or slip-on PVC wire markers with legible machine-printed markings and numbers. Adhesive or taped-on tags are not acceptable.
4. Wiring Interface: Wiring entering or leaving each panel, console, rack, or cabinet shall be terminated and identified as follows:
- a. Analog and discrete signal wiring shall be terminated at numbered terminal blocks.
  - b. Wiring for special signals such as communications, digital data, and multiplexed signals may be terminated at manufacturer's Standard connectors.

- c. All wiring shall be identified per the requirements of Division 16, ELECTRICAL.
5. Terminal Blocks: Terminal blocks for panels, consoles, -racks, and cabinets shall meet the following requirements:
  - a. Provide sufficient terminations to accommodate both present and future needs. Wire all spare or unused panel mounted elements to their panels' terminal blocks. Provide the greater of 20 percent of all connected terminals or four unused spare terminals. In addition to the required spares, provide sufficient terminals to accommodate the cables that are routed through that panel (see MULTI-CONDUCTOR CONTROL CABLE SCHEDULE appended to Division 16, ELECTRICAL).
  - b. Provide 300-volt for controls and 600-volt for power screw clamp compression, dead front barrier type terminal blocks with current bar providing direct contact with wire between the compression screw and yoke. Provide yoke, current bar, and clamping screw constructed of high strength and high conductivity metal. Use yoke that guides all strands of wire into the terminal. Use current bar providing vibration-proof connection. Supply terminals that allow connection of wire without any preparation other than stripping. Rail mount individual terminals to create a complete assembly. Provide terminals constructed such that jumpers can be installed with no loss of space on terminal or rail.
  - c. No more than two wires may be terminated on any single terminal. Size all terminal block components to allow insertion of all necessary wire sizes and types. Supply terminal blocks with marking system allowing the use of preprinted or field marked tags. Provide UL approved terminal blocks manufactured by Weidmuller, Ideal, Electrovert, or equal.
6. Grounding: Panels, consoles, racks, and cabinets shall be provided with an internal copper grounding bus for all ground connections.
7. Relays:
  - a. Control circuit switching shall be accomplished with relays. These relays, for interfacing and control applications, shall be the compact general-purpose plug-in type having low coil inrush and holding current characteristics. Contact arrangements shall be rated for not less than 10 amperes at 120V ac or 28V de. A status indicating light shall be provided as part of each relay. Nonlatching relays shall have a single coil. Latching relays shall have two coils, unlatching being accomplished by energizing one coil, and latching being accomplished by energizing the other coil. Relays shall have plain plastic dust covers, test buttons, and mounting sockets with screw terminals and holddown springs. Relays shall be UL recognized. Relays shall be Potter and Brumfield KUP or KUL Series; Struthers-Dunn Series 219; or equal.
  - b. Time delay functions shall be accomplished with time delay relays. Units shall be adjustable time delay relays with the number of contacts and contact arrangements required. Contacts shall be rated for 10 amperes at 120V ac. Integral knob with calibrated scale shall be provided for adjustment of time delay. Time delay rangeability shall be at least 10:1. Operating voltage shall be 120V ac, plus 10 percent, -15 percent at 60-Hz. Operating temperature shall be -20 degrees F to 165 degrees F. Repeat timing accuracy shall be

- plus or minus 10 percent over the operating range. Units shall be Square D Type JCK; Allen Bradley Bulletin 700, Type HT; or equal.
- c. All relays shall have a screw terminal interface with the wiring. Terminals shall have a permanent, legible identification. Relays shall be mounted such that the terminal identifications are clearly visible and the terminals are readily accessible.
8. Programmable Controller:
    - a. Programmable controllers shall be all solid-state units capable of performing the same functions as conventional relays, timers, counters, and drum sequencers as well as arithmetic and other special functions necessary to perform the required control functions .
    - b. Units shall have a minimum of 64 internal control relays, 16 timer/counters, and four 16 stop drum sequencers. The units shall have a minimum of 256 words of nonvolatile memory.
    - c. Units shall have a minimum of 12 discrete inputs and 8 discrete outputs. Inputs and outputs shall have optical isolation rated at 2500-volt rms. Discrete inputs shall be 120V ac. Discrete outputs shall be rated for 2 amps at 120V ac. Each input and output shall have an LED ON/OFF status indicator.
    - d. Units shall have a minimum of 25 percent excess capacity for inputs, outputs, internal coils, registers and other necessary functions .
    - e. Units shall be capable of operating in a hostile industrial environment (i.e., heat, electrical transients, RFI, vibration, etc.,) without fans, air conditioning, or electrical filtering. Units shall operate from 0 to 60 degrees C and up to 95 percent humidity, noncondensing.
    - f. Units shall be provided with all hardware and software necessary to connect and interface with the unit to troubleshoot and program the PLC and/or HMI. Digital copies of the project programming files for the PLC and/or HMI shall also be provided. All software and hardware shall be the latest design and current release at the time of installation. All software and hardware shall be licensed in the name of the Owner.
    - g. Programmable controllers' final documentation shall include an updated version of all items provided in the Submittals During Construction.
    - h. Programmable controllers shall be Square D – Modicon Quantum or Square D – Modicon Momentum.
  9. Electrical Surge and Transient Protection
    - a. General: All control panels and field-mounted electrical and electronic components shall be equipped with suitable surge arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges and nearby electrical devices.
    - b. Suppressor Locations: Surge suppression equipment described herein shall be installed in the following locations:
      - i. At the point of connection between each equipment item, including AC powered transmitters and its power supply conductors (direct wired equipment).
      - ii. On all analog pairs at each end when the pair travels outside of a building.

- iii. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment.
  - c. Power Supply Suppressor Assemblies: Suppressors suitable for connection to 120-volt, single-phase power supplies, shall be EDCO "HSP SERIES", or equal. Suppressors suitable for connection to 480-volt, 3-phase power supplies, shall be Square D J9200-9A, or equal.
  - d. Analog Signal Cable Suppressor Assemblies: Suppressors shall be EDCO SRA-64 Series, or equal. Suppressors shall be epoxy encapsulated within a phenolic enclosure. Suppressor assembly shall be flame retardant. Suppressor assemblies shall be four lead devices and shall include a threaded mounting/grounding stud .
  - e. Grounding: Surge suppressor grounding in field panels and field instrumentation shall be coordinated with Division 16, ELECTRICAL and suppressor manufacturer's requirements. Control panels shall be provided with an integral copper grounding bus for connection of suppressors and other required instrumentation .
10. Front-of-Panel Devices: The following devices shall be used in conjunction with NEMA 1 and NEMA 12 panels to provide conformity with Section PROCESS INSTRUMENTATION AND CONTROL SYSTEM (PICS).
- a. Potentiometer: Units shall be three-terminal potentiometers. Units shall have oiltight construction, resolution of 1 percent and linearity of plus or minus 5 percent. Units shall be single-hole, panel mounting accommodating panel thicknesses between 1/8 and 1/4 inch. Units shall have legend plates with service markings. Units shall be Allen Bradley, Model 800T; Cutler Hammer, Model 10250T; or equal.
  - b. Indicating Lights: Units shall be LED, heavy-duty, push-to-test type, oiltight, industrial type with integral transformer as required for 120V ac applications. Units shall have screwed on prismatic glass lenses in colors noted, and shall have factory engraved legend plates for service legend. Units shall be Cutler-Hammer Type 10250T; General Electric CR2940U; or equal.
  - c. Pushbutton, Momentary: Units shall be heavy-duty, oiltight, industrial type pushbuttons with momentary contacts rated for 10 amperes continuous at 120V ac. Button shall have full guard. Units shall have standard size legend plates with black field and white markings for service legend. Units shall be Square D, Class 9001, Type K, Cutler-Hammer, Type T; General Electric, Type CR-2940; or equal.
  - d. Selector Switch: Units shall be heavy-duty, oiltight, industrial type selector switches with contacts rated for 120V ac service at 10 amperes continuous. Units shall have standard size, black field, legend plates with white markings, for service legend. Operators shall be black knob type. Units shall be single-hole mounting, accommodating panel thicknesses from 1/16-inch minimum to 1/4-inch maximum. Units with up to four selection positions shall be Cutler-Hammer Type T, Square D Type K, or equal. Units with up to 12 selection positions shall be Rundel-Iddec Standard Cam Switch, Electros witch, 31; or equal.
11. The following devices shall be used in conjunction with NEMA 4X panels to provide conformity with the plant instrument control system:

- a. Potentiometer, Watertight: Units shall be three-terminal potentiometers. Units shall have heavy-duty watertight construction, resolution of 1 percent and linearity of plus or minus 5 percent. Units shall be single-hole, panel mounting accommodating panel thicknesses between 1/8 and 1/4 inch. Units shall have engraved legend plates with service markings. The potentiometer shall have NEMA 4X construction. Unit shall be Allen-Bradley Bulletin 8001-1, or equal.
- b. Indicating Lights, Watertight: Units shall be LED, heavy-duty, push to-test type, watertight, industrial type with integral transformer for 120V ac applications. The lights shall be rated for NEMA 4X watertight, corrosion-resistant service. Units shall have screwed on prismatic lenses, and shall have factory engraved legend plates for service legend. Units shall be Square D Type SK; Allen Bradley Type 800H; or equal.
- c. Pushbutton, Momentary, Watertight: Units shall be heavy duty, watertight, industrial type pushbuttons with momentary contacts rated for 120V ac service at 10 amperes continuous. The pushbuttons shall be rated for NEMA 4X watertight, corrosion resistant service. Units shall have standard size, black field, legend plates with white markings for service legend. Button color shall be as noted. Units shall be Square D Type SK; Allen Bradley Type 8001-1; or equal.
- d. Selector Switch, Watertight: Units shall be heavy duty, watertight, industrial type selector switches with contacts rated for 120V ac service at 10 amperes continuous. The switches shall be rated for NEMA 4X watertight, corrosion-resistant service. Units shall have standard size, black field, legend plates with white markings, for service legend. Operators shall be black knob type. Units shall have the number of positions and contact arrangements as noted. Units shall be single hole mounting, accommodating panel thicknesses from 1/16-inch minimum to 1/4-inch maximum. Units shall be Square D Class 9001, Type SK; Allen Bradley Type 800H; or equal.

G. Nameplates, Name Tags, and Service Legends:

1. All components provided with the package system, both field and panel mounted, shall be provided with permanently mounted name tags bearing the entire ISA tag number of the component. Panel mounted tags shall be plastic; field mounted tags shall be stamped 316 stainless steel (22 gauge minimum thickness). Panel face mounted instrument name tags shall be mounted to the instrument behind the panel face.
2. Service legends (integrally mounted with instrument) and nameplates shall be engraved, rigid, laminated plastic type with adhesive back. Provide sufficient service legends and nameplates to adequately describe the functions of panel face mounted instruments. Color shall be black with white letters and letter height shall be 3/16 inch.
3. Each panel shall be provided with a face mounted laminated nameplate as specified above. Color shall be black with white letters 1/2-inch high.

H. Standard Light Colors and Inscriptions:

1. Unless otherwise noted in the individual Equipment Specifications, the following color code and inscriptions shall be followed for the lenses of all indicating lights depending on the operation of the component:

<u>Inscription(s)</u>	<u>Color</u>
ON	Red
OFF	Green
OPEN	Red
CLOSED	Green
LOW	Amber
FAIL	Red
HIGH	Amber
AUTO	White
MANUAL	Amber
LOCAL	White
REMOTE	Amber

2. Lettering shall be black on white with white and amber lenses. Lettering shall be white on black with red and green lenses.

I. Standard Pushbutton Colors and Inscriptions:

1. Unless otherwise noted in the individual Equipment Specifications the following color code and inscriptions shall be followed for all pushbuttons:

<u>Inscription(s)</u>	<u>Color</u>
ON	Black
OFF	Red
OPEN	Red
CLOSE	Green
START	Red
STOP	Green
RESET	Red
EMERGENCY STOP	Red

2. All unused or noninscribed buttons shall be black. Lettering shall be black on white with white and yellow buttons. Lettering shall be white on black with black, red and green buttons.

**2.5 SPARES, EXPENDABLES, AND TEST EQUIPMENT**

- A. Provide in sufficient quantity all spare material, expendable material, tools, test equipment, etc., necessary to maintain complete operation of the Control Systems for a minimum of one year. Items shall include the following:



1. Selector switches, pushbuttons, and indicating lights: 20 percent, one minimum, of each type used.
2. Light Bulbs: 100 percent, two minimum, of each type used.
3. Fuses: 100 percent, two minimum, of each type used.
4. Surge Suppressors: 20 percent, one minimum, of each type used.

## **PART 3 WORKMANSHIP**

### **3.1 GENERAL**

- A. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance.

### **3.2 CORROSION PROTECTION**

- A. All control panels, enclosures, and other equipment containing electrical or instrumentation and control devices, including spare parts, shall be protected from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, the capsules shall be provided within the shipping containers and equipment as recommended by the capsule manufacturer. During the construction period, the capsules shall be replaced periodically in accordance with the capsule manufacturer's recommendations. All capsules shall be replaced by the Contractor just prior to Owner's final acceptance of the equipment. The corrosion inhibiting vapor capsules shall be Northern Instruments Model Zerust VC or Hoffman Model A-HCI. NEMA 4X panels shall be provided with breather/drains, Crouse-Hinds Model ECD18; or equal.

### **3.3 CLEANING AND TOUCHUP PAINTING**

- A. Contractor shall keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touchup scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

### **3.4 PANELS AND PANEL MOUNTED EQUIPMENT**

- A. Panels and panel mounted equipment shall be assembled as far as possible at the Equipment Suppliers' plants. No work, other than correction of minor defects or minor transit damage, shall be done on the panels at the jobsite .

### **3.5 EQUIPMENT FURNISHED BY A SUPPLIER AND INSTALLED BY CONTRACTOR**

- A. Equipment Suppliers shall observe and- advise on the installation to the extent required to certify in writing that the equipment will perform as required .

**3.6 ELECTRICAL POWER AND SIGNAL WIRING**

- A. Control and signal wiring external to the control panels and all power wiring shall conform to the requirements of Division 16, ELECTRICAL.
- B. Control and signal wiring in control panels shall be restrained by plastic ties or ducts. Hinge wiring shall be secured at each end so that any bending or twisting will be around the longitudinal axis of the wire and the bend area shall be protected with a sleeve.
- C. Arrange wiring neatly, cut to proper length, and remove surplus wire. Provide abrasion protection for any wire bundles which pass through holes or across edges of sheet metal.
- D. Use manufacturer's recommended tool with the proper sized anvil, for all crimp terminations. No more than two wires may be terminated in a single crimp lug and no more than two lugs may be installed on a single screw terminal.
- E. Wiring shall not be spliced or tapped except at device terminals or terminal blocks.

**3.7 INSPECTIONS**

- A. All materials, equipment, and workmanship shall be subject to inspection at any time by the Engineer or his representatives. Correct any work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Engineer at no additional cost to the Owner.

**END OF SECTION**

# **SECTION 11510 ELECTRIC MOTORS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. The purpose of this section is to list requirements common to electric motors provided as part of equipment specified in other sections. When it applies, this section will be referenced in other equipment specifications.

### **1.2 RELATED SECTIONS**

- A. See Division 1 - GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this project.
- B. Division 11 - All Sections specifying motorized equipment
- C. Division 16 - All Sections specifying connection and wiring of motors

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate payment will be allowed for work covered under this section. All costs for work performed under this Section shall be included in the lump sum price as bid for the project.

### **1.4 REFERENCE STANDARDS**

- A. Motors shall be designed, manufactured and tested in accordance with the latest revisions of the following standards:
  - 1. EPACT Standards
  - 2. NEMA Standards
  - 3. NFPA 70 Standards
  - 4. IEEE Standards
  - 5. ANSI Standards

### **1.5 PERFORMANCE**

- A. Motors shall be adequate for long periods of inactivity and the effects of an atmosphere that is made corrosive by traces of chemicals normally present in a wastewater treatment plant, and environmental conditions existing at the plant site such as high humidity, insects, plant life, fungus, rodents, etc. When motors are to be inactive in excess of 30 days, the Contractor shall maintain the bearings and rotate the shaft twice a month for the duration of the inactive period. On motors equipped with internal space heaters, the Contractor may be required to connect the heaters in advance of startup to prevent excessive moisture from collecting within the motor. The insulation of all drip-proof and

weather-protected motors shall be specially designed for use in atmospheres containing moisture and corrosive fumes, which are normally encountered in wastewater treatment plants.

**1.6 RESPONSIBILITY**

- A. The equipment, including the motor and the device to be driven, shall all be supplied from a single source in order to obtain single source responsibility for the equipment system. The driven equipment supplier shall assume all responsibility for mating the motor and the driven equipment to obtain the performance specified under the Detailed Equipment Specification and as specified herein for motors and drive systems.

**1.7 ACCEPTABLE MOTOR MANUFACTURERS**

- A. Louis Allis
- B. General Electric
- C. TECO-Westinghouse
- D. Marathon
- E. Reliance
- F. Or equal

**1.8 SUBMITTALS DURING CONSTRUCTION**

- A. Submittals during construction shall be made in accordance with Division 1, GENERAL REQUIREMENTS.

**1.9 SERVICE CONDITIONS**

- A. All equipment shall be selected and modified as required for operation at the jobsite service conditions. Specified capacities are at sea level standard conditions. All motors provided under this section shall be capable of performing at rated horsepower, exclusive of service factor, at jobsite service conditions.

**PART 2 PRODUCTS**

**2.1 GENERAL**

- A. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these specifications, unless otherwise indicated:

1. Unless otherwise specified, all ac motors shall be squirrel-cage induction type, rated for continuous duty at service conditions specified herein.
2. The connected load (maximum horsepower required) of each motor shall not exceed its nameplate horsepower rating (exclusive of service factor) under any anticipated operating condition. All motors with a suffix of "S" shall have a service factor of 1.0. All other motors unless otherwise noted shall have a service factor of 1.15 or greater.
3. Motors with synchronous speeds of 1,800 rpm or higher shall have full load current not exceeding the values in NEC Table 430-250. Motors with synchronous speeds of 1,200 rpm shall have full load current not exceeding 110 percent of the above values.
4. Motors shall be rated for a 40 degree C ambient temperature unless specifically indicated otherwise.
5. Motors shall have a grounding terminal in the motor terminal junction box. The bolt which attaches the grounding lug to motor terminal junction box shall not be used for any other purpose (such as mounting the box to the motor).
6. Drip-proof and weather protected motors shall have 316 stainless steel screens over all openings.
7. Motors specified as totally enclosed and rated 5 horsepower or less may be either fan ventilated or nonventilated. Motors specified as totally enclosed and rated over 5 horsepower shall be fan ventilated.
8. If motors are subjected to overhanging loads, they shall be designed for such loads. The magnitude of overhanging load shall not exceed the recommendations of the motor manufacturer.
9. Motors operated in a vertical position shall be designed for vertical operation and shall have thrust and guide bearings with a rated life of 50,000 hours (minimum) as defined by AFBMA Standards. Horizontal motors mounted vertically shall not be allowed. Thrust bearings for motors 125 horsepower and larger shall be oil lubricated.
10. Bearings for motors up to 1 horsepower shall be permanently lubricated sealed ball bearings, or open-type ball bearings installed in labyrinth sealed end bells with pipe plugs. Bearings for motors 1 horsepower and above shall be open-type ball bearings installed in labyrinth sealed end bells with pipe plugs.
11. Motors shall have Class F insulation with Class B rise.
12. Motors 15 horsepower and above shall be NEMA starting Code F (maximum). Motors below 15 horsepower shall have manufacturers standard starting code letter.

## 2.2 STARTING DUTIES

- A. Motors shall start and accelerate to running speed without injurious heating.
- B. During testing and preliminary operation and startup, a number of successive starts may be made. The time interval between each start shall not be less than the minimum time allowed by the manufacturer's warranty. Squirrel-cage induction motors shall be designed and braced satisfactorily for full voltage starting in accordance with paragraph 1.4 Reference Standards.

**2.3 VOLTAGE RATINGS**

- A. Motors 1/2 horsepower and larger shall be designed to operate on alternating current, 3-phase, 480-volt, 60-Hz. Motors below 1/2 horsepower shall be single phase and shall be designed to operate on 120-volt, 60-Hz, unless indicated otherwise.

**2.4 MOTOR CONDUIT BOXES**

- A. Conduit boxes shall be NEMA 4 made of cast iron or aluminum to match motor frame, and shall be of adequate size to permit terminating leads. It shall be possible to rotate these boxes in steps of 90 degrees. Conduit box shall be of adequate size to accept, and have a sufficient number of correct size openings to accept all required conduits. (See Electrical Drawings for size and number of conduits.)

**2.5 TORQUE CLASSIFICATION**

- A. Motors shall match the torque requirements of the driven equipment in accordance with NEMA standards.

**2.6 MOTOR EFFICIENCY AND POWER FACTOR**

- A. Motors shall be NEMA Design B, of the energy efficient type unless otherwise specified. The motor guaranteed minimum efficiency at full load shall not be less than the values shown in Table B-1.

**Table B-1. Allowable Minimum Full-Load Efficiencies for Motors Covered by EPA Act**

Number of Poles	Nominal Full-Load Efficiency					
	Open Motors			Enclosed Motors		
Motor Horsepower/ Standard Kilowatt Equivalent	6	4	2	6	4	2
1/7.75	80.0	82.5	—	80.0	82.5	75.5
1.5/1.1	84.0	84.0	82.5	85.5	84.0	82.5
2/1.5	85.5	84.0	84.0	86.5	84.0	84.0
3/2.2	86.5	86.5	84.0	87.5	87.5	85.5
5/3.7	87.5	87.5	85.5	87.5	87.5	87.5
7.5/5.5	88.5	88.5	87.5	89.5	89.5	88.5

10/7.5	90.2	89.5	88.5	89.5	89.5	89.5
15/11	90.2	91.0	89.5	90.2	91.0	90.2
20/15	91.0	91.0	90.2	90.2	91.0	90.2
25/18.5	91.7	91.7	91.0	91.7	92.4	91.0
30/22	92.4	92.4	91.0	91.7	92.4	91.0
40/30	93.0	93.0	91.7	93.0	93.0	91.7
50/37	93.0	93.0	92.4	93.0	93.0	92.4
60/45	93.6	93.6	93.0	93.6	93.6	93.0
75/55	93.6	94.1	93.0	93.6	94.1	93.0
100/75	94.1	94.1	93.0	94.1	94.5	93.6
125/90	94.1	94.5	93.6	94.1	94.5	94.5
150/110	94.5	95.0	93.6	95.0	95.0	94.5
200/150	94.5	95.0	94.5	95.0	95.0	95.0

- B. The guaranteed minimum efficiency shall be submitted with the shop drawings. Any motor not meeting the minimum efficiency shall be rejected. If the motor is found in the field to be of a lower efficiency than specified, it shall be replaced with a new motor meeting these specification and efficiency requirements.

**2.7 EMBEDDED WINDING TEMPERATURE DETECTOR SYSTEM**

- A. Provide embedded winding temperature protection devices in all motors with the suffix "T" in their definition of type (i.e. Type 2T). In a separate motor-mounted junction box, provide thermal protection system consisting of thermal sensors in each phase of the motor, a normally open contact for stator overtemperature, protector monitoring relay, a RESET button, and any other parts required for correct functioning. The system shall operate on 120V ac, single-phase. Contact shall close when power is applied if temperature is satisfactory and shall return to open when the temperature setting is exceeded. The contact shall be sealed into the overtemperature condition until temperature returns to normal and either the power is cycled or the RESET button is pushed. Temperature sensors shall be set low enough to prevent motor damage and high enough to prevent nuisance tripping when operating within the motor rating. Temperature detector system shall be Texas Instruments 50AA; or equal.

**2.8 MOTOR SPACE HEATERS**

- A. Provide anticondensation space heaters in all motors with a Horsepower rating of 50 Hp or larger. In addition, provide heaters in all motors with the suffix "H" in their definition of type (i.e. Type 2H). The heater shall be rated 120V ac with power requirements in accordance with the motor manufacturer's recommendation for the particular frame size

and type. Wire leads shall be brought out to a conduit box on the motor and clearly identified.

## **2.9 MOTORS OPERATED FROM ADJUSTABLE SPEED DRIVE CONTROLLERS**

- A. Provide motors with sufficient nameplate rated capacity to drive the specified equipment and to provide the specified margin between system capacity and connected load after any motor derating required to allow for extra heating in the motor due to the harmonic content in the voltage supplied by the controller. The adjustable frequency drive system supplier shall be responsible for a properly sized and completely compatible drive system.

## **2.10 SEVERE DUTY MOTORS**

- A. Motor types designated as severe duty shall have the following minimum features as defined by NEMA:
  - 1. Totally enclosed, mill and chemical duty
  - 2. Cast iron frames and end shields
  - 3. Stainless steel hardware, drains, breathers and nameplates
  - 4. Capillary type drains/breathers
  - 5. Nonsparking, corrosion-resistant fans
  - 6. Gasketed conduit boxes
  - 7. Nonhygroscopic epoxy varnish sealed windings
  - 8. Extra dips and bakes of insulating varnish for moisture protection of windings

## **2.11 PROTECTED STANDARD DUTY MOTORS**

- A. Motor types designated as protected standard duty shall have or be:
  - 1. Open drip-proof enclosure
  - 2. Standard NEMA frame
  - 3. Gasketed conduit boxes
  - 4. Encapsulated or sealed windings
  - 5. Manufacturer's standard features in addition to those specified herein for the particular size required

## **2.12 UNPROTECTED STANDARD DUTY MOTORS**

- A. Motor types designated as unprotected standard duty shall have or be:
  - 1. Totally enclosed
  - 2. Standard NEMA frame
  - 3. Gasketed conduit boxes
  - 4. Manufacturer's standard features in addition to those specified herein for the particular size required



## 2.13 MOTOR TYPES

- A. Motor types indicated in the detailed equipment specifications are defined as follows :
- Type 1 Horizontal, single-winding, protected standard duty motor. The motor shall have a Bearing Life of 50,000 hrs., ABMFA B-10
  - Type 2 Horizontal, single-winding, unprotected standard duty motor. The motor shall have a Bearing Life of 50,000 hrs., ABMFA B-10
  - Type 3 Horizontal, single-winding, severe duty motor. The motor shall have a grease, positive bearing lubrication system with a life of 100,000 hrs., ABMFA B-10
  - Type 4 Vertical, solid shaft, single-winding severe duty motor. The motor shall have a positive bearing lubrication system with a life of 100,000 hrs., ABMFA B-10, Frames and Endshields of cast iron NEMA Style P-Base and moisture seal between conduit box and motor frame.
  - Type 5 Vertical, hollow shaft, single-winding, single-speed, protected standard duty motor. The motor shall have or be suitable for a Non-reverse ratchet, Bowl adjustment nut, and a 50,000 hrs bearing.
  - Type 6 Horizontal, single winding, single speed, NEMA Design "D," protected standard duty motor suitable for jogging and plugging duty or hoist duty, with anti friction bearings and a time rating of 30 minutes.
  - Type 7 Explosion-proof, single-speed, horizontal motor. The motor shall have or be suitable for Full voltage Starting and suitable for application in a Class I, Division 1, Group D hazardous area.
  - Type 8 Same as Type 5 except part-winding start.
  - Type 9 Same as Type 5 except inverter duty rated

## 2.14 FACTORY TESTS

- A. Perform short commercial tests, including running light current at rated voltage, high potential, and locked rotor current on all motors.
1. Field Tests: The following tests shall be made on all motors 15 horsepower or larger prior to putting motors IN SERVICE and acceptance by the Owner. All tests shall be performed in the presence of the Engineer. Provide all test equipment with certified calibration label to perform the following tests:
    - a. Measurement of no load and full load current (each phase)
    - b. Determination of locked rotor current (measured when starting motor connected to driven equipment)
    - c. Insulation resistance test
    - d. Inspection of bearings and lubrication system
    - e. Rotation check
    - f. Coupling check
    - g. All other tests specified in the motor manufacturer O&M manuals for field tests prior to startup

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. All motors shall be designed, manufactured, and tested in accordance with the latest edition of NEMA MG 1. All motors shall be able to start, accelerate, and drive the design load of the driven equipment without exceeding any of the specified design requirements.
- B. Installation of all equipment shall be in strict accordance with the manufacturer's recommendations and as reviewed by the Engineer. Furnish services for the initial phase of setting and aligning of the equipment, and after the installation is completed, for startup and testing as required by the various sections of these Specifications.
- C. Finish shall be manufacturer's standard gray or ANSI 61 gray over a primer and rust inhibitor, unless detailed under motor types and in accordance with Section 09900.

**END OF SECTION**

# **SECTION 16010 ELECTRICAL - GENERAL PROVISIONS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. Division 16, ELECTRICAL, covers the work necessary for the complete electrical system. Furnish materials, labor, and equipment in accordance with these Specifications and the accompanying Drawings.
- B. This section covers general requirements applying to all sections included in Division 16, ELECTRICAL.
  - 1. Electrical- general provisions.
  - 2. Basic materials and methods.
  - 3. Raceways.
  - 4. Conductors.
  - 5. Grounding.

### **1.2 WORK PROVIDED OUTSIDE THIS CONTRACT**

- A. Incoming underground transformer primary power cables, materials, installation, termination, and connection; under this Contract, provide trench, and backfill, and duct system.
- B. Transformers supplying main electrical service to the facility; site preparation and transformer pad included in this Contract.
- C. Power company metering facilities, except as indicated.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment will be made for the work covered in this section. The payment for all work covered in this section will be included in the lump sum amount listed in the BID.

### **1.4 RELATED SECTIONS**

- A. Components for heating, ventilating, air conditioning systems, including conductors for control wiring, unless specifically shown on Electrical Drawings.
- B. Control panels and systems that may be constructed or furnished by ELECTRICAL SUBCONTRACTOR as shown on the ELECTRICAL DRAWINGS shall meet all requirements of SECTION 11400 - CONTROL PANELS AND SYSTEMS.

## **1.5 MATERIALS AND EQUIPMENT FURNISHED UNDER OTHER DIVISIONS WITH RACEWAY AND ELECTRICAL CONDUCTORS FURNISHED, INSTALLED, AND CONNECTED UNDER DIVISION 16, ELECTRICAL**

- A. All Equipment shown on the plans with an electrical or control wiring connection shown on the plans.
- B. Section 11400 - Control Panels and Systems
- C. Section 13320 - Process Instrumentation and Control Systems

## **1.6 INSPECTION OF THE SITE AND EXISTING CONDITIONS**

- A. The electrical drawings were developed from information supplied by the Owner. Verify all scaled dimensions prior to submitting bids.
- B. Before submitting a bid, visit the site and determine conditions at the site and at all existing structures in order to become familiar with all existing conditions and electrical systems which will, in any way or manner, affect the work required under this Contract. No subsequent increase in Contract cost will be allowed for additional work required because of the Contractor's failure to fulfill this requirement.

## **1.7 RESPONSIBILITY**

- A. The Contractor shall be responsible for:
  - 1. Complete systems in accordance with the intent of these Contract Documents.
  - 2. Coordinating the incoming electrical service with the electric utility company providing service.
  - 3. Coordinating the details of facility equipment and construction for all Specification Divisions which affect the work covered under Division 16, ELECTRICAL.
  - 4. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.

## **1.8 DEFINITIONS**

- A. Integrated Equipment Short Circuit Rating (IESCR): The short circuit current at the line terminals of an assembly which the assembly can interrupt without damage beyond that allowed by NEMA or UL for the short circuit design test for similar equipment; unless otherwise noted, IESCR is expressed in 3-phase, symmetrical, rms amps.

## **1.9 INTENT OF DRAWINGS**

- A. Electrical plan drawings show only general locations of equipment, devices, and raceway, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway, subject to the review of the Engineer.

**1.10 DEPARTURES FROM CONTRACT DOCUMENTS**

- A. Submit to the Engineer in writing details of any necessary, proposed departures from these Contract Documents and the reasons therefore. Make no such departures without written review of the Engineer.

**1.11 SUBSTITUTION OF MATERIALS AND EQUIPMENT**

- A. In accordance with provisions elsewhere in these Contract Documents, manufacturers' names and catalog numbers stated herein are intended to indicate the type and quality of equipment or materials desired. Unless substitution is specifically forbidden, proposed alternatives may be submitted for approval.
- B. Make requests for review of alternatives in writing to the Engineer before submittals of shop drawings. Provide sufficient material or data to allow evaluation of the proposed alternative and determination of compliance with these Contract Documents. List any proposed deviations from these Contract Documents.

**1.12 SUBMITTALS**

- A. Provide complete manufacturers' descriptive information and shop drawings for equipment, material, and devices furnished under Division 16, ELECTRICAL, interconnection and connection diagrams, in accordance with provisions elsewhere in these Contract Documents.
- B. Submittals shall be forwarded to the Engineer in groups in the order listed below. All items in a group must be submitted together. Submittals shall be scheduled to allow review and return of one group before another is submitted.

Group	Items Covered by Specification Section
A	Electrical- General Provisions
B	Motor Control, Switchboards
C	Raceways, Conductors, Grounding
D	Basic Materials and Methods

- C. Make submittals in accordance with Division 1, GENERAL REQUIREMENTS and the following schedule:
- D. In addition to submittals for specific items that may be mentioned in other sections, furnish shop drawing information and submittal data on the following items as applicable to the project:
  - 1. Separately mounted circuit breakers and nonfused disconnect switches.
  - 2. PVC conduit and PVC coated conduit.
  - 3. Liquid-tight flexible metal conduit.
  - 4. Wireway.

5. Pull boxes and junction boxes with any dimension over 12 inches.
6. Terminal junction boxes.
7. Precast handholes.
8. 600-volt conductors.
9. Control cable.
10. Lighting fixtures.
11. Light poles.
12. Surge protective equipment.
13. Manual transfer switches.
14. Conductor and Field Test Data

## **PART 2 PRODUCTS AND EQUIPMENT, COMMON REQUIREMENTS**

### **2.1 GENERAL**

- A. Unless otherwise indicated, provide all first-quality, new materials and equipment, free from any defects, in first-class condition, and suitable for the space provided. Provide materials and equipment listed by UL wherever standards have been established by that agency.
- B. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

### **2.2 STANDARD PRODUCTS**

- A. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturers' latest standard design that conforms to these Specifications.

### **2.3 CLASSIFICATION OF AREAS**

- A. The following areas are classified nonhazardous and shall use watertight, dusttight, and corrosion resistant NEMA 4X materials and methods unless otherwise specified under specific equipment section:

Outdoor Areas outside of wetwell and near wetwell hatches and vents. See drawings for details.

- B. The following areas are not classified and shall use NEMA 4X materials and methods:

All areas not covered above.

**2.4 EQUIPMENT FINISH**

- A. Unless otherwise indicated, provide materials and equipment with manufacturers' standard finish system, in accordance with Division FINISHES. Provide manufacturers' standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with Division FINISHES with ANSI No. 61, light gray color.

**2.5 EQUIPMENT RATINGS**

- A. Equipment shall be applied only within its rating. Equipment ratings shown are minimums. Voltage and current ratings shall be as required to adequately power the connected equipment. Fault current ratings shall be as shown for the particular item or for the next upstream device that has a fault current rating shown.

**2.6 ALTITUDE**

- A. Provide materials and equipment suitable for installation and operation under rated conditions at the elevations given on the plans in feet above mean sea level.

**2.7 OUTDOOR EQUIPMENT**

- A. Provide equipment and devices to be installed outdoors or in unheated enclosures capable for continuous operation within an ambient temperature range of 10 degrees F to 110 degrees F. If the equipment being provided will not work within these ambient temperatures then additional heating or cooling must be provided at no additional cost to the Owner.

**2.8 MOUNTING HARDWARE FOR ALL ITEMS**

- A. Provide all fasteners and mounting hardware of Type 316 stainless steel. This shall include screws, anchors, bolts, nuts, fasteners, rivets, or any other fastening or mounting hardware.
- B. Unistrut: Provide all unistrut mounting channel made of Aluminum or 316 Stainless Steel and all track and mounting hardware for unistrut out of 316 Stainless Steel.

**PART 3 INSTALLATION, COMMON REQUIREMENTS****3.1 GENERAL**

- A. Install materials and equipment correctly using workers skilled in the Particular trade. Provide work which has a neat and finished appearance. Carry out work in accordance with NEMA Standard of Installation, unless otherwise specified.
- B. Coordinate electrical work with Engineer and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the plant during construction.

- C. Check the approximate locations of light fixtures, electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having furred locations. In the event of conflicts, notify the Engineer in writing. The Engineer's decision shall govern. Make modifications and changes required to correct conflicts.

**3.2 PROTECTION DURING CONSTRUCTION**

- A. Throughout this Contract, provide protection for materials and equipment against loss or damage in accordance with provisions elsewhere in these Contract Documents. Throughout this Contract, follow manufacturers' recommendations for storage. Protect everything from the effects of weather. Prior to installation, store items in clean, dry, indoor locations. Store in clean, dry, indoor, heated locations items subject to corrosion under damp conditions, and items containing electrical insulation, such as transformers, conductors, motors, and controls. Energize all space heaters furnished with equipment. Provide temporary heating, sufficient to prevent condensation, in transformers, switchboards, motors, and motor control centers which do not have space heaters.
- B. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. When equipment intended for indoor installation is installed at the Contractor's convenience in areas where it is subject to dampness, moisture, dirt, or other adverse atmosphere until completion of construction, ensure that adequate protection from these atmospheres is provided that is acceptable to the Engineer. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction. Energize all space heaters furnished with equipment.

**3.3 MATERIAL AND EQUIPMENT INSTALLATION**

- A. Follow manufacturers' installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between the manufacturers' instructions, codes and regulations, and these Contract Documents, follow Engineer's decision. Keep copy of manufacturers' installation instructions on the jobsite available for review at all times.
- B. Use appropriate conduit and conductor entry fittings with enclosures which maintain the specified enclosure environmental capability after proper installation.

**3.4 REMOVAL OR RELOCATION OF MATERIALS AND EQUIPMENT**

- A. Where existing materials and equipment are removed or relocated, remove all materials no longer used such as studs, straps, conduits, and wires. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4-inch below the final finished surface .
- B. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface in a neat and workmanlike manner. Follow any specific instructions given under Division FINISHES.



### **3.5 CUTTING AND PATCHING**

- A. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition. Use skilled craftsmen of the trades involved.

### **3.6 LOAD BALANCE**

- A. The Drawings and Specifications indicate circuiting to electrical loads and distribution equipment. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, etc.

### **3.7 MOTOR ROTATION**

- A. After final service connections are made, check and correct the rotation of all motors.
- B. Coordinate rotation checks with the Engineer and the Contractor responsible for the driven equipment. Submit a written report to the Engineer for each motor verifying that rotation has been checked and corrected.

### **3.8 CLEANING AND TOUCHUP PAINTING**

- A. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove all materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. If extensive damage is done to equipment paint surfaces, refinish the entire equipment in a manner that provides a finish equal to or better than the factory finish, that meets the requirements of the Specifications, and that is acceptable to the Engineer.

## **PART 4 INSPECTION**

### **4.1 GENERAL**

- A. Allow materials, equipment, and workmanship to be inspected at any time by the Engineer, or their representatives. Correct work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Engineer.

## **PART 5 STANDARDS, CODES, PERMITS, AND REGULATIONS**

### **5.1 GENERAL**

- A. Perform all work; furnish and install all materials and equipment in full accordance with the latest applicable rules, regulations, requirements, and specifications of the following:
1. Local Laws and Ordinances.
  2. State and Federal Laws.
  3. National Electrical Code (NEC).
  4. State Fire Marshall.
  5. Underwriters" Laboratories (UL).
  6. National Electrical Safety Code (NESC).
  7. American National Standards Institute (ANSI).
  8. National Electrical Manufacturer's Association (NEMA).
  9. National Electrical Contractor's Association (NECA) Standard of Installation.
  10. Institute of Electrical and Electronics Engineers (IEEE).
  11. Insulated Cable Engineers Association (ICEA).
  12. Occupational Safety and Health Act (OSHA).
  13. National Electrical Testing Association (NETA).
  14. American Society for Testing and Materials (ASTM).
- B. Conflicts, if any, that may exist between the above items will be resolved at the discretion of the Engineer.
- C. Wherever the requirements of the Specifications or Drawings exceed those of the above items, the requirements of the Specifications or Drawings govern. Code compliance is mandatory. Construe nothing in the Contract Documents as permitting work not in compliance with these codes.
- D. Obtain all permits and pay all fees required by any governmental agency having jurisdiction over the work. Arrange all inspections required by these agencies. On completion of the work, furnish satisfactory evidence to the Engineer that the work is acceptable to the regulatory authorities having jurisdiction.

## **PART 6 OPERATIONS AND MAINTENANCE MANUALS**

### **6.1 GENERAL**

- A. Provide operations and maintenance manuals in accordance with provisions of GENERAL REQUIREMENTS, in these Contract Documents. Provide the number of copies specified therein containing:
1. Information required by GENERAL REQUIREMENTS.
  2. Information listed under individual specification items.
  3. Provide reproducible time-current coordination study.

## **PART 7 TEMPORARY ELECTRIC POWER**

### **7.1 GENERAL**

- A. Refer to General Conditions in these Contract Documents for necessary provisions for electric power used during construction.

## **PART 8 CHECKOUT AND STARTUP**

### **8.1 GENERAL**

- A. During checkout and startup of the various plant systems, provide a crew of skilled craftsmen to be available for checkout and troubleshooting activities as required by the Engineer. Since coordination with other crafts and contractors will often be required, the craftsmen assigned to checkout must be available outside normal working hours when necessary.

## **PART 9 TESTS**

### **9.1 GENERAL**

- A. Carry out tests specified hereinafter and as indicated under individual items of materials and equipment specified in other sections.

### **9.2 OPERATIONS**

- A. After the electrical system installation is completed and at such time as the Engineer may indicate, conduct an operating test for approval. Demonstrate that the equipment operates in accordance with the requirements of these Specifications and Drawings. Demonstrate that protective functions are operating properly and are properly incorporated in control system, circuit breaker, and motor control center circuitry. Perform the test in the presence of the Engineer. Furnish all instruments and personnel required for the tests. The Owner will furnish the necessary electric power.

### **9.3 VOLTAGE**

- A. When the installation is essentially complete and the plant is in operation, check the voltage at the point of termination of the power company supply system to the project. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
- B. Record the supply voltage (all three phases simultaneous on the same graph) for 24 hours during a normal working day. Submit the recording with a letter of transmittal to the Owner and his authorized representative within 5 days of the date the test was taken.

- C. If an unbalance (as defined by NEMA) exceeds 1 percent, or if the voltage varies throughout the day and from loaded to unloaded conditions more than plus or minus 4 percent of nominal, make a written request to the power company, with a copy to the Owner and his authorized representative, that the condition be corrected. If corrections are not made, obtain from a responsible power company official a written statement that the voltage variations and/or unbalance are within their normal standards. Send a copy of this statement with a transmittal letter to the Owner and his authorized representative .

**9.4 EQUIPMENT LINE CURRENT AND VOLTAGE**

- A. Check the line current and voltage in each phase for each piece of equipment. If the power company makes adjustments to the supply voltage magnitude or balance, make the line current check after the adjustments are made. If any phase current in any piece of equipment is above the rated nameplate current, determine the cause of the problem and submit it in writing to the Engineer.

**9.5 CONDUCTOR AND EQUIPMENT FIELD TESTS**

- A. The Contractor shall furnish the necessary test equipment and labor to test the insulation of the electrical equipment and circuits before they are energized. A 500-volt megger shall be used to test the insulation resistance of equipment and circuits insulated for 600 volts.
- B. The insulation to ground of each conductor shall be tested and must be at least 5 megohms. The insulation resistance of motors shall be at least 80 percent of the factory test value. The insulation resistance of motors for which factory test values are not available must be at least equal to the values required for low voltage transformers.
- C. The insulation resistance of low voltage transformers must be at least as great as the following values:

Case Temperature	Test Value
0	12.0
10	7.0
20	4.2
30	2.5
40	1.5
50	1.0

- D. Any equipment which does not pass test shall be replaced or repaired to bring the insulation resistance up to the value of comparable new equipment. Any piece of equipment which passes the above test but is significantly below values obtained for comparable new equipment or which the Contractor or the Engineer believe to be faulty on the basis of insulation resistance tests shall be replaced or repaired as above.
- E. A written record of all insulation resistance tests shall be kept. The test records shall show the Contractor, tester, witness (if any), date, air temperature at test site, test

instrument manufacturer, model and serial number. For each tested circuit or apparatus, the records shall show the test voltage and test results in megohms. These records shall be turned over to the Engineer on request or at the end of the work.

## **PART 10 GUARANTEE**

### **10.1 GENERAL**

- A. Materials, equipment, and workmanship shall be guaranteed in accordance with provisions of General Conditions in these Contract Documents.

## **PART 11 PAYMENT**

### **11.1 GENERAL**

- A. Payment for the work in this section will be included as part of the lump sum bid amount stated in the Proposal.

**END OF SECTION**



# **SECTION 16050 BASIC MATERIALS AND METHODS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section covers the work necessary to furnish and install, complete, the materials specified hereinafter.

### **1.2 RELATED SECTIONS**

- A. See CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS, and Section ELECTRICAL - GENERAL PROVISIONS, which contain information and requirements that apply to the work specified herein and are mandatory for this project.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate payment for the work in this section will be made. The work specified herein shall be included as part of the lump sum bid amount stated in the BID.

### **1.4 REFERENCES**

- A. NFPA 70 - National Electrical Code.
- B. NEMA ICS 1 - General Standards for Industrial Control Systems.
- C. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
- D. NEMA ICS 3 - Industrial Systems.
- E. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- F. IEEE
- G. UL

### **1.5 SUBMITTALS**

- A. Make submittals after award of Contract in accordance with Division 1, GENERAL REQUIREMENTS, and Section ELECTRICAL - GENERAL PROVISIONS .

## **PART 2 PRODUCTS**

### **2.1 SERVICE ENTRANCE**

- A. When service entrance work is required provide materials and work, as required by the electric utility which will provide service to the facility, for installation of service conductors, and mounting of utility company equipment. All such materials and work shall meet the requirements of the utility company.

### **2.2 OUTLET AND DEVICE BOXES**

- A. General: Provide boxes not less than 2 inches deep, unless shallower boxes are required by structural conditions and are specifically accepted by the Engineer. Do not use box extensions to provide wiring space required by the NEC. For hollow masonry construction, provide boxes of sufficient depth so that conduit knockouts or hubs are in the masonry void space.
- B. Sheet Steel (SS) Boxes: Provide zinc- or cadmium-plated boxes of the one piece drawn type. Install 4-inch minimum octagonal boxes for ceiling outlets, except where smaller boxes are required for the particular fixture being installed. Use concrete type boxes in poured concrete slabs. Provide 2 inch by 4-inch minimum boxes for switches and receptacles. Provide plaster rings where required.
- C. Cast Aluminum (CA) Boxes: Provide PVC coated boxes of cast aluminum with gasketed, watertight, cast ferrous metal covers and stainless steel screws in PVC coated conduit systems. Provide boxes with threaded conduit hubs and cast mounting lugs where lugs are required. Use Crouse-Hinds or Appleton Type FS or FD boxes, or equal.
- D. Nonmetallic (NM) Boxes: Provide PVC boxes with gasketed, watertight covers and stainless steel screws. Provide boxes with conduit hubs and any required mounting lugs. Use Carlon Type FS boxes, or equal.

### **2.3 JUNCTION AND PULL BOXES**

- A. Utilize NEMA 4x stainless steel watertight enclosures for outdoor or wet locations and where subscript WP is indicated at the box location on the Drawings.
- B. Where outlet boxes are used as junction or pull boxes, use materials as specified under OUTLET AND DEVICE BOXES.
- C. Where larger sheet steel boxes are required, utilize boxes of code-gauge, galvanized steel with full-access screw covers mounted with corrosion resistant machine screws.
- D. Where larger cast metal boxes are required, use neoprene gasketed, watertight boxes with hinged, cast metal full-access covers, stainless steel cover hardware, and drilled and tapped conduit entrances. Use Crouse Hinds Series W, O.Z./Gedney Series Y boxes, or equal. For below grade conduit, use Crouse-Hinds Type WJBF, O.Z./Gedney Series YR,



or equal, minimum size 8 inches by 8 inches by 6 inches. For hazardous areas, use boxes applicable for the location and hazardous atmosphere present.

- E. Where larger nonmetallic boxes are required, they shall be gasketed, watertight, corrosive resistant, and have a hinged, full-access screw cover. The hinge and machine screws shall be stainless steel. The box and cover shall be of high impact strength fiberglass-reinforced polyester material with stability to high heat. The boxes shall have conduit hubs and any required mounting lugs. The minimum size shall be 7 inches by 10 inches by 6 1/2 inches deep. Use Crouse-Hinds Type NJB boxes, or equal.
- F. Use concrete boxes of reinforced, cast concrete, 10 inches by 17 inches minimum inside dimensions, Brooks Products, Inc., No. 3-1/2T, Quikset W.17, or equal. Mark cast iron cover, ELECTRICAL, TELEPHONE, or as shown on the Drawings.
- G. Use special boxes where indicated on the Drawings.

## 2.4 TERMINAL JUNCTION BOXES (TJB)

- A. Provide hinged-cover terminal junction boxes of the required type and size where indicated. Utilize NEMA 12 enclosures for indoor dry locations. Utilize NEMA 4X enclosures, as described under JUNCTION AND PULL BOXES, for outdoor or wet locations and where subscript WP is indicated at the box location on the Drawings. Provide terminal blocks with a separate connection point for each conductor entering or leaving the box. Provide 25 percent spare terminal points. Paint interior surfaces with white enamel or lacquer.

## 2.5 WIRING DEVICES

- A. Switches:
  1. General Use Switches: Provide specification grade, totally-enclosed, ac type, quiet tumbler switches meeting NEMA WD 1 performance standards and Federal Specification W-S-896E, and capable of control of 100 percent tungsten filament and fluorescent lamp loads. Use switches rated at 20 amps, 120/277 volts. Provide operating handles colored ivory in office areas, and brown in all other areas. Switches shall have screw terminals.
  2. Weatherproof Switches: Use switches as specified mounted in a cast metal box with gasketed, weatherproof device plate as specified.
  3. Switches with Pilot Lights: Provide switches as specified with 125 volt, neon light with red jewel, or lighted toggle which is lighted when the switch is ON.
  4. Acceptable Manufacturers: Bryant, General Electric, Hubbell, Pass and Seymour, or equal.
- B. Receptacles:
  1. Single and Duplex: Provide specification grade receptacles meeting NEMA WD 1 performance standards and Federal Specification W-C 596, and having a contact arrangement such that contact is made on two sides of each inserted blade without

detent. Use two-pole, three wire grounding type receptacles rated 20 amps, 125 volts, NEMA Configuration 5-20R, and with screw type wire terminals suitable for No. 10 AWG. Provide high strength thermoplastic bases colored ivory in office areas, and brown in all other areas. Acceptable manufacturers: Bryant, General Electric, Hubbell, Pass and Seymour, Sierra, or equal.

2. Weatherproof Receptacles: Receptacles shall be specified above mounted in a cast metal box with gasketed, UL listed weatherproof device plate as specified below.
3. Ground Fault interrupter (GFI) Receptacles: Provide duplex specification grade GFI receptacles tripping at 5 milliamps; rated 20 amps, 120 volts, NEMA Configuration 5-20R. Use units meeting NEMA WD 1, fitting standard sized outlet boxes, having provision for testing, and ivory in color. Use standard model where ground fault protection is needed. Do not use feed-thru model. Acceptable manufacturers: Pass and Seymour, Square D, General Electric, or equal.
4. Corrosion-Resistant Receptacles: Receptacles shall meet the requirements for single and duplex Receptacles, above. Receptacle bodies shall be made from polycarbonate or other corrosion-resistant material. Metal parts shall be stainless steel or nickel plated brass or bronze. Receptacles shall be mounted in a nonmetallic box with a gasketed corrosion-resistant device plate as specified below.
5. Special Purpose Receptacles: Provide receptacles of the type, rating, and number of poles indicated or required for the anticipated purpose. Furnish a matching plug with cord-grip features for each special purpose receptacle.

C. Device Plates:

1. General:
  - a. Provide plates fitting closely and tightly to the box on which they are to be installed. On surface mounted boxes, provide plates which do not extend beyond the sides of the box unless the plates do not have sharp corners or edges.
  - b. Use plate material compatible with the box material such that galvanic corrosion of the plate and/or box does not occur.
2. Metal (M) Plates: Provide specification grade, one-piece, 0.040-inch nominal minimal thickness, No. 430 satin finish stainless steel device plates with oval-head, matching mounting screws.
3. Engraved Plates: Where device titles are indicated, provide device plates engraved with the designated titles. Provide engraved letters, numbers, or characters 3/16-inch high with filler of red color.
4. Cast Metal (CM) Plates: Provide cast metal device plates of copper-free aluminum with gaskets and stainless steel screws with oval heads.
5. Weatherproof (WP) Plates:
  - a. Where weatherproof receptacles are designated, the receptacle shall be installed in the specified box with a gasketed, weatherproof, cast metal or stainless steel cover plate UL listed with individual cap over each receptacle opening and stainless steel mounting screws. Utilize plates with caps held tightly closed with stainless steel springs when receptacle is not in use. Acceptable manufacturers: General Electric, Bryant, Hubbell, Sierra, Pass and Seymour, Crouse-Hinds, Bell, or equal.
  - b. Where weatherproof switches are designated, the switch shall be installed in the specified box with a gasketed, weatherproof, cast metal cover plate

incorporating an external operator for the internal switch and with stainless steel mounting screws. Acceptable manufacturers and types: Crouse-Hinds DS-181 or DS-185, Appleton FSK-1VTS or FSK-1VS, or equal.

6. Raised Sheet Metal (SM) Plates: Provide 1/2-inch high zinc- or cadmium-plated steel device plates designed for one-piece drawn type sheet steel boxes.
7. Corrosion-Resistant (CR) Plates: Where corrosion-resistant receptacles are designated, the receptacle shall be installed in the specified box with a gasketed, weatherproof, corrosion-resistant, nonmetallic cover plate individual cap over each receptacle opening and stainless steel mounting screws. Use plates with caps held tightly closed with stainless steel springs when receptacle is not in use. Acceptable manufacturers: General Electric, Hubbell, or equal.

## 2.6 CIRCUIT BREAKERS, INDIVIDUAL, 0 TO 600 VOLTS

- A. General: Provide circuit breakers of the indicating type showing ON/OFF and TRIPPED positions of the operating handle. Do not use single-pole circuit breakers with handle ties where multipole circuit breakers are indicated. Utilize multipole circuit breakers designed so that an overload on one pole automatically causes all poles to open. Provide circuit breakers meeting the requirements of NEMA AB 1. Circuit breakers shall have a minimum interrupting rating equal to the maximum fault current available at the point of application or they shall be part of an assembly with an integrated equipment short circuit rating at least as great as the fault current available at the point of application. Where circuit breakers are used as service entrance equipment, provide units UL labeled for that use. Provide circuit breakers suitable for use with 75 degrees C wire at full NEC 75 degrees C ampacity.
- B. Inverse Time Type:
  1. Provide thermal-magnetic circuit breaker, unless otherwise shown, for one- and two-pole breakers, breakers operating at 240V or less, and three-pole branch circuit breakers operating at 480V.
  2. Provide solid state trip circuit breakers with an adjustable short-term function, unless another type breaker is required for coordination, for three-pole, 480V feeder circuit breakers with not more than one downstream, 480V, overcurrent protective device, excluding protective devices provided as part of a process equipment package. Such breakers shall be Westinghouse Seltronic Circuit Breakers, Square D, Type ME or PE Circuit Breakers, or equal.
  3. Provide solid state trip circuit breakers with at least the following adjustment: long time pickup, long time delay, short time pickup, short time delay, I-squared t for circuit breakers not covered by either of the above cases. Such breakers shall be General Electric Circuit Breakers with Microversatrip; Westinghouse Circuit Breakers with Digitrip; or equal.
- C. Instantaneous Only Type: Instantaneous only circuit breakers shall have only an instantaneous trip element. The breakers shall be used only as part of a listed combination motor starter. Instantaneous only breakers shall be sized with a continuous rating of at least 115 percent of the full-load current of the motor served. The trip setting shall be continuously adjustable from a lowest setting of not more than 700 percent to a highest setting of not less than 1,300 percent of the motor full-load current. Instantaneous

only breakers shall be Westinghouse MCP; General Electric Mag-Break, Square D, Mag-Guard; or equal.

**2.7 TERMINAL BLOCKS 0 TO 600 VOLTS**

- A. Provide terminal blocks for termination of control circuits at enclosures and for termination of power and control conductors where shown. Terminal blocks shall be solderless box lug type, rated for the highest phase-to-phase voltage used in the enclosure. Provide terminal blocks manufactured by Square D, General Electric, or equal.

**2.8 SURGE PROTECTIVE DEVICES**

A. Standards

- 1. ANSI/IEEE: C62.41, C62.45 & C62.48
- 2. National Electric Code: 285
- 3. Underwriters Laboratories: UL1449 & UL1283

B. Surge Suppressor

- 1. SPD shall be listed in accordance with UL1449 third edition and UL1283.
- 2. SPD shall be marked with a short circuit current rating equal to or greater than available fault currents at the point of installation.
- 3. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G in WYE systems, and L-L, L-G, in delta systems.
- 4. Each mode including N-G shall be fused with a UL Recognized 200kAIC surge rated fuse and incorporate a thermal cutout device.
- 5. If a dedicated breaker for the SPD is not provided, the service entrance SPD shall include an integral UL recognized disconnect switch.
- 6. UL 1449 Second edition Listed and Recognized component suppression voltage rating shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>MCOV</u>
208Y/120	400V	400V	400V	150V
480Y/277	700V	700V	700V	320V

- 7. SPD shall have a minimum EMI/RFI filtering of -50dB at 100kHz.
- 8. SPD shall monitor all modes; L-N, L-G and N-G.
- 9. SPD shall have a five-year warranty.
- 10. SPD shall be provided with individual suppression modules per phase for ease of maintenance.
- 11. SPD shall be provided with 1 set of NO/NC dry contacts to signal SCADA system when suppression module fails.
- 12. SPD shall be provided with surge event counter.
- 13. SPD shall be provided with spare suppression module mounted in cabinet.
- 14. Unit to be rated for 160kA minimum.

- C. Installation
  - 1. SPD shall be installed per manufacturer's installation instructions with lead lengths as short and straight as possible. Gently twist conductors together.
- D. SPD shall be installed on the load side of the main disconnect or as directed by engineer.Manufacturers
  - 1. Device to be PTX 160 by Advanced Protection Technologies, Inc., American Power Conversion, Siemens or engineering approved equal.

## 2.9 CHANNEL FRAMING

- A. Provide Unistrut channel framing, fittings, and hardware of stainless steel in corrosive areas and aluminum in other areas. Contractor may propose, for review by the Engineer, a welded framework as a substitution provided there is no additional cost to the Owner.

## 2.10 LIGHT FIXTURES

- A. Provide light fixtures as schedules on the drawings.
- B. All LED fixtures shall have a 5 year warranty minimum

## 2.11 MANUAL TRANSFER UNIT (MTS)-SPRING HILL PUMP STATION (PS#2)

- A. Docking Station shall have integrated Rotary Manual Transfer Switch (MTS).
  - 1. MTS shall be two positions. Utility-Portable Generator.
  - 2. MTS shall be located behind pad lockable door to prevent any tampering by unauthorized personnel.
  - 3. MTS shall be fully rated for manual transfer under load. MTS' that require a no load manual transfer do not meet these specifications.
- B. Enclosures:
  - 1. Surface mount, NEMA 3R rain-tight, aluminum enclosure with rake system for cable entry at the bottom.
  - 2. Cable entry area at the bottom of the enclosure shall be covered by a hinged trap door.
    - a. It shall be possible to close and lock the front door to the enclosure with the trap door open, and power cables connected through the bottom of the enclosure. The enclosure shall maintain NEMA 3R integrity with power cables connected.
  - 3. Front Cover:
    - a. Hinged.
    - b. Gasketed.
    - c. Pad-lockable latch.
  - 4. Finishes:
    - a. Paint after fabrication. Powder coated Hammer Gray.
- C. Phase, Neutral, and Ground Buses:
  - 1. Material: Silver-plated, Tin-plated or Hard-drawn copper, specified upon order.

- 2. Equipment Ground Bus: bonded to box.
- 3. Isolated Ground Bus: insulated from box.
- 4. Ground Bus: 25%, 50% or 100% of phase size.
- 5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
- 6. Round edges on bus.

- D. Inputs connectors shall be Camlok style mounted on 45° angle plate or on gland plate.
- E. Output connectors shall be broad range set-screw type, located behind an aluminum barrier.
- F. Lockable rake system with reinforced support struts to reduce cable theft.
- G. Voltage & Phase shall be as shown on project one line drawing. Camlocks provided for incoming generator power shall be color coded as appropriate for the specified voltage.
- H. Amperage rating shall be as shown on project one line drawing.
- I. Provide unit as manufactured by Trystar or approved equal.

**2.12 MANUAL TRANSFER UNIT (MTS)-ALL OTHER PUMP STATIONS**

- A. Provide manual transfer switch with receptacle as specified on the drawings..

**PART 3 EXECUTION**

**3.1 OUTLET AND DEVICE BOXES**

- A. Provide a box suitable for the conditions encountered at each outlet in the wiring or raceway system and sized in accordance with the NEC. Use the listed types unless otherwise indicated or accepted.

- 1. Types to be Provided, Steel Raceway System:
  - a. Finished area, lighting circuits above 8 feet Sheet steel boxes
  - b. All others Cast steel boxes
- 2. Types to be Provided, Nonmetallic Raceway System:
  - All use Nonmetallic boxes
- 3. Installation:
  - a. Mount boxes at the following heights unless otherwise indicated (heights are to the centerline of the box):
 

Wall switches	48 inches above floor
Thermostats	54 inches above floor
Convenience receptacles:	
Indoor:	
Office, lab, general use areas, etc.	Flush device plate bottom or side with top of the backsplash on counter tops, or 6 inches above counter tops without backsplash; 12 inches above floor unless otherwise indicated

Industrial areas, machine shops, warehouses. work shops etc.	48 inches above floor
Outdoor - All areas	As indicated
Special Purpose	As Indicated

- b. Where above heights do not suit the building construction or finish, locate boxes where directed by the Engineer.
- c. Locations indicated are approximate. Study the Drawings in relation to spaces and equipment surrounding each outlet. When necessary, with the approval of the Engineer, relocate outlets to avoid interference with mechanical equipment or structural features. Locate all light switches on lock side of doors.
- d. Mount all boxes plumb and level. Use flush mounted boxes with concealed conduits. Make edges of boxes flush with finished surface. Provide proper type extension rings or plaster covers for this purpose. For flush mounted boxes, make holes in the surrounding surface no larger than required to receive the box.
- e. Install boxes in a secure, substantial manner supported independently of conduit by attachment to the building structure or a structural member. Use bar hangers in frame construction, or fasten boxes directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded, threaded studs on steelwork. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields. Boxes embedded in concrete or masonry need not be additionally supported. Utilize galvanized mounting hardware in industrial areas.
- f. Provide flush or recessed lighting fixtures with separate junction boxes when required by the fixture terminal temperature. Where boxes support fixtures, provide proper means of attachment with adequate strength.
- g. Open no more knockouts in sheet steel boxes than are actually required. Seal any unused openings in any type box.

### 3.2 JUNCTION AND PULL BOXES

- A. Where indicated on the Drawings, and where necessary to terminate, branch-off, or redirect multiple conduit runs, provide and install appropriately designed junction boxes. Furnish and install pull boxes where necessary in the raceway system to facilitate conductor installation. Provide pull boxes to limit conduit runs to less than 150 feet and to contain no more than the equivalent of three right-angle bends unless accepted by the Engineer.
  1. Types to be Provided:
    - a. Use boxes of the types listed for specific locations under OUTLET AND DEVICE BOXES.
    - b. Use outlet boxes as junction boxes and pull boxes wherever possible and allowed by applicable codes.

- c. Provide watertight, cast metal or cast concrete boxes as indicated for below grade conduit. Provide watertight, cast metal or watertight, nonmetallic boxes as indicated for above grade locations.
2. Installation:
- a. Make all boxes accessible. Do not install boxes in finished areas unless accepted by the Engineer. Mount all boxes plumb and level. Use flush mounted boxes with concealed conduits. Make edges of boxes flush with the final surface.
  - b. Install boxes in a secure, substantial manner, supported independently of conduit by attachment to the building structure or a structural member. Use bar hangers in frame construction, or fasten boxes directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded threaded studs on steelwork. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields. Boxes embedded in concrete or masonry need not be additionally supported. Utilize galvanized mounting hardware in industrial areas.
  - c. Install boxes for conduits under grade flush with finished grade in locations outside of paved areas, roadways, or walkways.
  - d. If adjacent structure is available, the box may be mounted on the structure surface just above finished grade in accessible but unobtrusive location. If it is found desirable to locate boxes in paved areas, roadways, or walkways, obtain Engineer's written approval and utilize boxes and covers suitable for the weights to which they may be subjected.

**3.3 TERMINAL JUNCTION BOXES (TJB)**

- A. Install in accordance with all the requirements detailed under JUNCTION AND PULL BOXES above. Label each block and terminal with a permanently attached, nondestructible tag.

**3.4 WIRING DEVICES**

- A. Switches: Mount switches at the heights indicated under OUTLET AND DEVICE BOXES. Mount switches for switch operation in the vertical position.
- B. Receptacles: Mount receptacles at heights indicated under OUTLET AND DEVICE BOXES. Mount receptacles with grounding slot up except where horizontal mounting is indicated, in which case mount with neutral slot up. Ground receptacles to boxes with grounding wire, not by yoke or screw contact. Mount weatherproof receptacles with the hinge for the protective cover above (not at side, or below) the receptacle opening.
  - 1. Special Purpose Receptacles: Locate special purpose receptacles where shown. Install and mount the receptacles in accordance with the manufacturer's instructions and the applicable codes.



C. Device Plates:

1. Types to be Provided:
  - a. All outdoor and wet interior shall use Cast metal plates suitable for wet locations
  - b. Finished areas shall use Stainless Steel Metal Plates
  - c. All other areas shall use Cast metal plates
  - d. WP Designation shall be Weatherproof
2. Installation: Securely fasten device plates to switch or receptacle boxes or the wiring device contained therein. Install device plates used with flush mounted boxes with all four edges in continuous contact with the finished wall surfaces without the use of mats or similar materials. Plaster fillings will not be acceptable. Install device plates vertically or horizontally with an alignment tolerance of 1/16-inch. Do not use sectional type device plates.

**END OF SECTION**



# **SECTION 16075 ELECTRICAL IDENTIFICATION**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section includes electrical identification materials.

### **1.2 RELATED SECTIONS**

- A. 16050 – Basic Materials and Methods
- B. 16425 – Switchboards
- C. 16470 – Panelboards

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment will be made for the work covered in this section. The payment for the work in this section will be included as part of the lump sum bid amount stated in the BID.

### **1.4 REFERENCES**

- A. NFPA 70 - National Electrical Code.

### **1.5 SUBMITTALS**

- A. Submittals shall be made in accordance with Division 1, GENERAL REQUIREMENTS, and Section ELECTRICAL - GENERAL PROVISIONS.

## **PART 2 PRODUCTS**

### **2.1 NAMEPLATES**

- A. Nameplates: Engraved three-layer laminated plastic, white letters on black background. Edges shall be chamfered. Minimum size shall be 1 inch high by 2.5 inches wide.
- B. Locations: Major items of electrical equipment including switchboards, motor control centers, panelboards, individual starters, safety switches, transformers and individual components of switchboards and motor control centers shall be marked with a nameplate to identify the equipment.

## C. Letter Size:

1. Use ¼ inch letters for identifying individual loads.
2. Use ½ inch letters for identifying equipment and grouped loads.

**2.2 UNDERGROUND WARNING TAPE**

## A. Manufacturers:

1. Terra-Tape
2. or equal

- B. Description: Provide heavy-gauge, red plastic tape of 6-inch minimum width for use in trenches containing electric circuits. Utilize tape made of material resistant to corrosive soil. Use tape with printed warning that an electric circuit is located below the tape.

**PART 3 EXECUTION****3.1 PREPARATION**

- A. Degrease and clean surfaces to receive nameplates and labels.

**3.2 APPLICATION**

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using screws or rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Warning Tapes: Bury warning tapes approximately 12 inches above all underground conduit runs or duct banks. Align parallel to and within 12 inches of the centerline of runs.

**END OF SECTION**

# **SECTION 16110 RACEWAYS**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section covers the work necessary to furnish and install, complete, electrical raceway systems.

### **1.2 RELATED SECTIONS**

- A. See CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS, contain information and requirements that apply to the work specified herein.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment will be made for the work covered in this section. The payment for the work in this section will be included as part of the lump sum bid amount stated in the BID.

### **1.4 REFERENCES**

- A. NFPA 70 - National Electrical Code.

### **1.5 SUBMITTALS**

- A. Submittals shall be made in accordance with Division 1, GENERAL REQUIREMENTS, and Section ELECTRICAL - GENERAL PROVISIONS.
- B. Multiple Channel Prewired Raceway submittals shall show the complete layout of all products that make up the complete system prior to installation with raceway lengths, device type, locations and circuit identification.

## **PART 2 PRODUCTS**

### **2.1 ALUMINUM RIGID CONDUIT**

- A. Use rigid aluminum conduit, including couplings, bushings, elbows, nipples, and other fittings, meeting the requirements of UL and the NEC. Do not use setscrew type couplings, bushings, elbows, nipples, and other fittings, unless approved by the Engineer. Aluminum conduit shall be threaded on both ends and threads shall be coated with anti-oxidant compound after cutting. Shall be produced in accordance with UL safety standard #6 and ANSI C80.1.

## 2.2 INTERMEDIATE METAL CONDUIT (IMC)

- A. Use intermediate metal conduit, including couplings, bushings, elbows, nipples, and other fittings, hot-dip galvanized and meeting the requirements of UL and the NEC. Do not use setscrew type couplings, bushings, elbows, nipples, and other fittings, unless approved by the Engineer. Intermediate metal conduit shall be threaded on both ends and threads shall be hot-dip galvanized after cutting. Shall be produced in accordance with UL safety standard #1242 and ANSI C80.6.

## 2.3 ELECTRIC METALLIC TUBING (EMT)

- A. Use electric metallic tubing, couplings, bushings, elbows, nipples, and other fittings meeting the requirements of ANSI C80.3, ANSI C80.4, UL, and the NEC. Use only compression type couplings, bushings, elbows, nipples, and other fittings, unless approved by the Engineer.

## 2.4 PVC SCHEDULE 40 CONDUIT

- A. Use rigid PVC Schedule 40 conduit, UL listed for concrete-encased, underground direct burial, concealed and direct sunlight exposed use, and UL listed and marked for use with conductors having 90 degrees C insulation. Use conduits, couplings, bushings, elbows, nipples, and other fittings meeting the requirements of NEMA TC 2 and TC 3, Federal Specification W-C-1094, UL, NEC, and ASTM specified tests for the intended use. Use only conduit with a factory formed bell on one end. Conduit that requires the use of couplings for straight runs will not be acceptable.

## 2.5 FLEXIBLE METAL CONDUIT, LIQUID-TIGHT

- A. Use UL listed liquid-tight flexible metal conduit consisting of galvanized steel flexible conduit covered with an extruded PVC jacket and terminated with nylon bushings or bushings with steel or malleable iron body and insulated throat and sealing O-ring.

## 2.6 PVC COATED ALUMINUM RIGID CONDUIT

- A. NEMA RN-1 or UL-6 rigid aluminum conduit with factory applied external 40 mil PVC coating and urethane interior coating. Prior to coating, treat conduit with a heat polymerizing adhesive so the bond between metal and coating is greater than the tensile strength of the coating. All couplings, fittings, conduit bodies, pipe straps, U bolts, beam clamps, flex connections and other accessories shall have factory applied PVC coating. Use PVC coated hubs for connection of coated conduits – locknuts are not acceptable.

## 2.7 WIREWAYS

- A. Provide screw-cover, indoor, outdoor, rain tight, steel-enclosed wireway and auxiliary gutter where indicated. Utilize wireways and fittings that are UL listed, have a cover that can easily be removed, and have a gray, baked enamel finish. Manufacturers and types: Square D Square-Duct; General Electric Type HS; or equal.

**2.8 RACEWAY FITTINGS**

- A. Use insulated throat bushings of metal with integral plastic bushings rated for 105 degrees C. For insulated throat bushings for rigid steel conduit, use Thomas & Betts Nylon Insulated Metallic Bushings, or O.Z. Gedney Type B.
- B. Use Myers Scru-Tite hubs.
- C. Use conduit bodies for rigid steel conduit of metal and sized as required by the NEC (NFPA 70-1984). Use Appleton Form 35 threaded Unilets; Crouse-Hinds Mark 9 or Form 7 threaded condulets; Killark Series O Electrolets; or equal, for normal conduit bodies for rigid steel conduit. Where conduit bodies for rigid steel conduit are required to be approved for hazardous (classified) locations, use conduit bodies manufactured by Appleton, or Crouse-Hinds.
- D. Use Appleton Type EYF, EYM, or ESU; or Crouse-Hinds Type EYS or EZS; sealing fittings for rigid steel conduit. Where condensate may collect on top of a seal, provide a drain by using Appleton Type SF or Crouse-Hinds Type EYD or EZD Drain Seal.
- E. Use Appleton Type ECDB or Crouse-Hinds ECD drain fittings for rigid steel conduit.
- F. Fittings for Liquid-Tight Flexible Metal Conduit: Use insulated throat connectors for liquid-tight flexible metal conduit of metal with an integral plastic bushing rated for 105°C, and of the long design type extending outside of the box or other device at least 2-inches. Use Thomas & Betts Super-Tite Nylon Insulated Connectors, or equal.
- G. Use cable sealing fittings forming a watertight nonslip connection to pass cords and cables into conduit. Size cable sealing fitting for the conductor OD. For conductors with OD's of 1/2 inch or less, provide a neoprene bushing where the conductor enters the connector. Use Crouse-Hinds CGBS, Appleton CG Series, or equal, cable sealing fittings.

**2.9 CABLE TRAY**

- A. Cable tray shall be HALF-RACK<sup>®</sup> as manufactured by B-Line<sup>®</sup> Systems, Inc. or Engineering Approved Equal.
- B. Cable Tray Sections and Components:
  - 1. Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated with splice hangers and all other necessary accessories. Provide cable tray with rounded edges and smooth surfaces in compliance with applicable standards, and with the following additional construction features.
  - 2. Cable tray materials and finish to be aluminum. All hardware and fasteners shall be zinc plated steel in accordance with ASTM B633.
  - 3. Rungs shall be spaced every 6 inches.
  - 4. Cable tray width shall be 9 inches.

5. Splice hangers must also be capable of acting as the support points for all thread rod.
6. Cable tray loading depth shall be 4 inches.
7. All splices and connectors must protect cables from the edges of the center rail and act as a barrier to prevent the center rail from transmitting hazardous gases or smoke; hardware must be installed vertically, so as not to interfere with the cables in the cable fill area.
8. Cable tray shall be capable of being installed flush against a flat surface without the use of spacers or brackets.
9. Where required, expansion splices shall allow for 1" of thermal expansion and contraction.

C. Loading Capacities and Testing

1. Upon request, manufacturer shall provide test reports in accordance with the latest revision of NEMA VE-1 / CSA C22.2 No. 126.1-98.
2. UL Classified: Provide products which are UL classified and labeled.

## 2.10 MULTIPLE CHANNEL PREWIRED RACEWAY

- A. The multioutlet assembly specified herein shall be the Isoduct Prewired System Series AL4320, as manufactured by Wiremold. Manufacturers requesting consideration as an alternative to the Isoduct Prewired Systems shall submit documentation establishing their product equality at least 10 days prior to bid date. Request shall include documentation of UL listings as both a Multioutlet Assembly and a Surface Metal Raceway and include a sample of the prewired components. A list of similar installations in service for two years or longer must be provided. Systems of other manufacturers may be considered equal, if in the opinion, and the written approval of the engineer, they meet all the performance standards specified herein.

B. Materials

1. Raceway shall have two (2) wiring compartments with field removable covers. Raceway shall have a nominal wall thickness of 0.078". Multiple compartment raceway shall have an integral dividing barrier isolating wiring compartments and provided with fittings that maintain the separation of compartments. Raceway covers shall be 12" in length to facilitate future modification. Covers must be removable with a standard straight blade screwdriver without marring. Raceway to have two covers and must allow each cover to be removed separately without allowing access into the compartment enclosed by the other cover.
2. Raceway shall be manufactured of extruded #6063-T5 aluminum and have an Ivory Power Coat finish. Dimensions of the raceway shall be 5-1/4" W x 1-3/4 H and each length of raceway shall be cut to specified job requirements. Field cutting of raceway will not be permitted.
3. Each receptacle shall be identified noting the panel number and circuit number from which it is fed. Receptacles rated higher than a NEMA 5-20R configuration shall also be provided with voltage, phase and amperage identified in the same manner. Raceway sections shall be provided with 12" [304.8mm] pigtails at feed locations for



ease of installation. Grounding shall be maintained by means of factory installed NEC sized grounding conductor(s) and utilize insulation displacement connectors as required.

4. Raceway covers shall have either holecut provision for communications outlets, if Wiremold Interlink Cabling System data connectors are used, or the voice and data/LAN outlets shall be factory mounted to the cover plates. The raceway must be capable of containing, but not limited to, snap-in modular jacks (3-pair, 4-pair, 4-pair keyed and MMJ), coaxial and F-connectors and communication grommets. Wiring connections of these devices shall be completed at the jobsite by the appointed contractor.
  5. The multioutlet assembly is to consist of factory assembled product with a full complement of fittings including, but not limited to, elbows (90°, internal and external), slide couplings for joining raceway sections, blank end caps for closing open ends of the raceway, and flat tees.
  6. The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (including Category 5), STP (150 ohm) Fiber Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons as well as write-on station identification labels shall be available.
- C. Raceway shall be installed with all appropriate fittings in accordance with the manufacturer's installation instructions and in compliance with all appropriate codes. Raceway is to be plumb, square, level and in alignment with casework or furniture as required.

## 2.11 ELECTRICAL PRECAST HANDHOLES

- A. Install handholes precast with 28-day, 3,000 psi minimum compressive strength concrete and designed for AASHTO H-20 loading. Minimum dimensions for handholes are shown on the Drawings. Increase these as required by use of extension sections to accommodate the several raceway entrances at their required elevations.
- B. Slope floors toward drain points, leaving no pockets or other nondraining areas. Provide a drainage outlet at the low point of the floor constructed with a heavy, cast iron, slotted or perforated hinged cover, and 4-inch minimum outlet and outlet pipe.
- C. Provide raceway entrances on all four sides. For raceways installed under this Contract, knockout panels or precast individual raceway openings may be used. On sides where no raceways are installed under this Contract, provide 12-inch high by 24-inch wide (minimum) knockout panels for future raceway installation.
- D. Utilize heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces. Provide indented type covers, solid top design, with two drop handles each. On the upper side of each cover, cast or burned by welder, in integral letters not less than 2 inches high appropriate titles, ELECTRIC HV (for above 600 volts), ELECTRIC LV (for 600 volts and below), or TELEPHONE. Field stamp covers with manhole or handhole numbers indicated on the Drawings.

- E. Provide a pulling iron embedded in the concrete wall opposite each raceway entrance and one in the floor vertically below the center of the handhole cover. Utilize 3/4-inch round stock securely fastened to the overall steel reinforcement before concrete is poured.
- F. Utilize handhole hardware of steel, hot-dip galvanized after fabrication.
- G. Manufacturers: Brooks Products, Inc.; Penn-Cast Products, Inc.; Concrete Conduit Company; Associated Concrete Products, inc.; or equal.

**2.12 COMMUNICATIONS HANDHOLE**

- A. Provide 12" X 12" x 24" polymer concrete box with 20k loading, open bottom, and hex head bolts for communication cabling.
- B. Logo to read "Communications".
- C. Manufacturer to be Armorcast or equal.

**2.13 RACEWAY TAGS**

- A. Provide permanent, nonferrous metal markers with raceway designations pressure stamped, embossed, or engraved onto the tag. Tags relying on adhesives or taped-on markers are not acceptable. Attach tags to raceways with noncorrosive wire.

**2.14 WARNING TAPE**

- A. Provide heavy-gauge, red plastic tape of 6-inch minimum width for use in trenches containing electric circuits. Utilize tape made of material resistant to corrosive soil. Use tape with printed warning that an electric circuit is located below the tape. Manufacturers and types: ITT Blackburn Type RT; Griffolyn Co. Terra-Tape; or equal.

**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Provide raceway systems meeting or exceeding the requirements of the NEC.

**3.2 PROTECTION DURING CONSTRUCTION**

- A. In addition to the requirements of the General Conditions, Division 1, GENERAL REQUIREMENTS, and Section ELECTRICAL - GENERAL PROVISIONS, prior to installation, store all products specified in this section in a dry location. Following installation, protect products from the effects of moisture, corrosion, and physical damage during construction. Keep openings in conduit and tubing capped with manufactured seals during construction.

**3.3 MINIMUM RACEWAY SIZE**

- A. Use no circular raceway less than 3/4 inch.

**3.4 REQUIRED RACEWAY TYPE FOR LOCATION AND INSTALLATION METHOD**

- A. Exterior, Exposed: PVC Coated Aluminum.
- B. Corrosive, Hazardous Areas (Pump Wetwell Area and Meter Vault): PVC coated Aluminum.
- C. Underground, Direct Earth Burial: PVC Schedule 40 conduit.
- D. Concrete Encased Raceways:
  - 1. PVC Coated Aluminum for analog circuits.
  - 2. PVC Schedule 40 conduit for all other circuits.
- E. Final Connection to Certain Equipment:
  - 1. Make final connection to motors, wall or ceiling mounted fans and unit heaters, dry type transformers, valves, local instrumentation, and other equipment where flexible connection is required to minimize vibration or where required to facilitate removal or adjustment of equipment, with 18-inch minimum, 60-inch maximum lengths of liquid-tight, PVC-jacketed, flexible steel conduit where the required conduit size is 4 inches or less. For larger sizes, use nonflexible conduit as specified.
  - 2. The flexible conduit shall be long enough to allow the item to which is connected to be withdrawn or moved off its base. Use liquid-tight flexible metal conduit in all areas.
- F. Special Locations:
  - 1. Use PVC Coated Aluminum:
    - a. Where conduit changes from underground and/or concrete embedded to exposed.
    - b. Under equipment mounting pads.
    - c. In exterior light pole foundations.
- K. Contractor shall use conduit types as specified in Section 3.4 unless noted otherwise on drawings.

**3.5 GENERAL INSTALLATION REQUIREMENTS FOR RACEWAYS**

- A. Location, Routing, and Grouping:
  - 1. Conceal or expose raceways as indicated. Group raceways in same area together. Locate raceways at least 12 inches away from parallel runs of heated piping for other utility systems.

2. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes to provide a neat appearance. Follow surface contours as much as possible.
3. Avoid obstruction of passageways. Run concealed raceways with a minimum of bends in the shortest practical distance considering the building construction and other systems.
4. In block walls, do not run raceways in the same horizontal course with reinforcing steel.
5. In outdoor, underground, or wet locations, use watertight couplings and connections in raceways. Install and equip boxes and fittings so as to prevent water from entering the raceway.
6. Paint all threads of galvanized conduits that are installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound before assembling. Touch up after assembly to cover nicks or scars.
7. Do not notch or penetrate structural members for passage of raceways except with prior approval of the Engineer.
8. Do not run raceways in equipment foundation pads.
9. Locate aboveground raceways concealed in poured concrete so that the minimum concrete covering is not less than 1-1/2 inches.
10. Avoid trapped runs, where possible. Aboveground trapped runs shall have a drain fitting installed at the low point.
11. Except at raceway crossings, separate raceways in slabs not less than six times the raceway outside diameter.
12. Raceways installed under slab floors shall lie completely under the slab with no part of the horizontal run of the raceway embedded within the slab.
13. Install concealed, embedded, and buried raceways so that they emerge at right angles to the surface and have none of the curved portion of the bend exposed. Provide support during pouring of concrete to ensure that raceways remain in position.

**B. Support:**

1. Support raceways at intervals not exceeding NEC requirements unless otherwise indicated. Support multiple raceways adjacent to each other by ceiling trapeze. Support individual raceways by wall brackets, strap hangers, or ceiling trapeze, fastened by wood screws on wood, toggle bolts on hollow masonry units, expansion shields on concrete or brick, and machine screws or welded thread studs on steelwork.
2. Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion shields.
3. Support all raceways from structural members only. Do not support from pipe hangers or rods, cable tray, or other conduit.
4. Do not use nails anywhere or wooden plugs inserted in concrete or masonry as a base for raceway or box fastenings. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

**C. Bends:**

1. Make changes in direction of runs with symmetrical bends or cast metal fittings. Make bends and offsets of the longest practical radius. Avoid field-made bends and offsets where possible. Do not heat metal raceways to facilitate bending.
  2. Factory elbows may be used in parallel or banked raceways.
  3. For PVC conduits, use factory-made elbows for all bends.
  4. Make no bends in flexible conduit that are smaller than allowable bending radius of the cable to be installed or that significantly restricts the conduit's flexibility.
- D. Bushing and Insulating Sleeves:
1. Where metallic conduit enters metal equipment enclosures through conduit openings, install a bonding bushing on the end of each conduit. Install a bonding jumper from the bushing to any equipment ground bus or ground pad.
  2. If neither exists, connect the jumper to a lag-bolt connection to the metallic enclosure.
  3. Use manufacturer's standard insulating sleeves in all metallic conduits terminating at an enclosure.
- E. Expansion Joints: Provide suitable expansion fittings for raceways crossing expansion joints in structures or concrete slabs, or provide other suitable means to compensate for expansion and contraction. Provide for the high rate of thermal expansion and contraction of PVC conduit by providing PVC expansion joints as recommended by the manufacturer and as required.
- F. PVC Conduit: Chamfer the end of all PVC conduit. Solvent weld PVC conduit joints with solvent recommended by the conduit manufacturer. Follow manufacturer's solvent welding instructions and provide watertight joints. Use acceptable PVC terminal adapters when joining PVC conduit to metallic fittings. Use acceptable PVC female adapters when joining PVC conduit to rigid metal conduit or IMC.
- G. Penetrations:
1. Seal the interior of all raceways entering structures at the first box or outlet with oakum or suitable plastic expandable compound to prevent the entrance into the structure of gases, liquids, or rodents.
  2. Dry pack with nonshrink grout around raceways that penetrate concrete walls, floors, or ceilings aboveground, or use one of the methods specified for underground penetrations.
  3. Where an underground conduit enters a structure through a concrete roof or a membrane waterproofed wall or floor, provide an acceptable, malleable iron, watertight, entrance sealing device. When there is no raceway concrete encasement specified or indicated, provide such a device having a gland type sealing assembly at each end with pressure bushings, which may be tightened at any time. When there is raceway concrete encasement specified or indicated, provide such a device with a gland type sealing assembly on the accessible side. Securely anchor all such devices into the masonry construction with one or more integral flanges. Secure membrane waterproofing to such devices in a permanently watertight manner.

4. Where an underground raceway without concrete encasement enters a structure through a nonwaterproofed wall or floor, install a sleeve made of Schedule 40 galvanized pipe. Fill the space between the conduit and sleeve with a suitable plastic expandable compound, or an oakum and lead joint, on each side of the wall or floor in such a manner as to prevent entrance of moisture. A watertight entrance sealing device as specified may be used in lieu of the sleeve.
5. Where raceways penetrate fire-rated walls, floors, or ceilings, fire stop openings around electrical penetrations to maintain the fire resistance rating.

### **3.6 INSTALLATION REQUIREMENTS FOR UNDERGROUND DIRECT BURIAL CONCRETE-ENCASED RACEWAYS**

#### **A. General:**

1. Coordinate installation of underground raceways with other outside and building construction work. Maintain existing outside utilities in operation unless otherwise authorized by the Engineer.
2. Remove entirely and properly reinstall all raceway installations not in compliance with these requirements.
3. Do not use union type fittings underground.
4. Provide a minimum cover of 2 feet over all underground raceways unless otherwise indicated.
5. Where a concrete-encased duct bank is installed over an extensive area of disturbed earth such as that within the periphery of a building, provide a separate concrete base under the duct bank to ensure stability of raceways during installation. Allow this base to set before the duct bank is installed.
6. Do not backfill underground direct burial and concrete-encased raceways until they have been inspected by the Engineer.
7. Warning Tapes: Bury warning tapes approximately 12 inches above all underground conduit runs or duct banks. Align parallel to and within 12 inches of the centerline of runs.

#### **B. Separation and Support:**

1. Separate parallel runs of two or more raceways in a single trench with preformed, nonmetallic spacers designed for the purpose. Install spacers at intervals not greater than that specified in the NEC for support of the type raceways used, and in no case greater than 10 feet.
2. Support raceways installed in fill areas to prevent accidental bending until backfilling is complete. Tie raceways to supports, and raceways and supports to the ground, so that raceways will not be displaced when concrete encasement or earth backfill is placed.

#### **C. Arrangement and Routing:**

1. Arrange multiple conduit runs substantially in accordance with any details shown on the Drawings. Locate underground conduits where indicated on the Drawings.

2. Make minor changes in location or cross-section as necessary to avoid obstructions or conflicts. Where raceway runs cannot be installed substantially as shown because of conditions not discoverable prior to digging of trenches, refer the condition to the Engineer for instructions before further work is done.
  3. Where other utility piping systems are encountered or being installed along a raceway route, maintain a 12-inch minimum vertical separation between raceways and other systems at crossings. Maintain a 12-inch minimum separation between raceways and other systems in parallel runs. Do not place raceways over valves or couplings in other piping systems. Refer conflicts with these requirements to the Engineer for instructions before further work is done.
  4. Provide insulated grounding bushings on all metallic raceways entering handholes. Provide bell-ends flush with handhole walls on all nonmetallic raceways entering handholes.
  5. Provide markers at grade to indicate the direction of underground conduits provided under this Contract. Provide markers consisting of double-ended arrows, straight for straight runs and bent at locations where runs change direction. Provide markers at all bends and at intervals not exceeding 100 feet in straight runs. Use markers made of sheet bronze not less than 1/4-inch thick embedded in and secured to the top of concrete posts. Use markers not less than 10 inches long and 3/4-inch wide and marked ELECTRIC CABLES in letters 1/4 inch high incised into the bronze to a depth of 3/32 inch.
  6. All conduits shall enter handholes and structures at right angles.
- D. Raceway Coating: Coat all metallic conduit embedded in the slab or buried under the slab and a minimum 6-inch coating length where metallic conduit exits concrete or ground. Coating shall be a bitumastic coating with a final coat thickness a minimum of 10 mils.
- E. Direct Earth Burial Conduit Zone Backfill Installation:
1. Backfill material for the conduit zone of direct burial conduit trenches may be selected from the excavated material if it is free from roots, foreign material, and oversized particles. Use material with 3/4-inch maximum particle size and suitable gradation for satisfactory compaction. Remove material if necessary to meet these requirements.
  2. Imported 3/4-inch minus gravel or sand may be used in lieu of material from the excavation.
  3. After conduits have been properly installed, backfill the trench with specified material placed around the conduits and carefully tamped around and over them with hand tampers. Final, tamped conduit cover shall be 4 inches minimum.
- F. Concrete Encasement:
1. Encase conduits in a concrete envelope sized as indicated and located at the elevation shown. Use 3,000 psi concrete as specified in Section CONCRETE.
  2. Maintain a grade of at least 4 inches per 100 feet, either from one handhole or pull box to the next, or from a high point between them, depending on the surface contour.
  3. Hold conduits for concrete-encased raceways securely in place by acceptable window type spacer supports. Where, in the opinion of the Engineer, ground

conditions are such as to require concrete forms, install forms constructed of materials and in a manner acceptable to the Engineer. No variations greater than 1/2 inch in 50 feet will be permitted from a straight line.

4. Envelopes may be poured directly against the sides of trenches if the cut is clean, even, and free of loose material. Remove loose material from trenches before and during pouring of concrete to ensure sound envelopes. Carefully spade concrete during pouring to eliminate all voids under and between raceways and honeycombing of the exterior surface.
  5. Do not use power-driven tampers or agitators unless they are specifically designed for the application, in order to ensure that the watertight integrity of the raceways is maintained.
  6. Generally, pour an entire concrete envelope in one continuous pour. Where more than one pour is necessary, terminate each pour in a sloped plane, and insert 3/4-inch reinforcing rod dowels extending into the concrete 18 inches minimum on each side of the joint. Obtain Engineer's approval for the number and location of dowels.
  7. Provide reinforcement where envelopes connect to handholes or building structures to prevent shearing of joints.
- G. Backfill Installation Above Conduit Zone of Direct Burial Conduit or Above Concrete Envelope of Concrete Encased Conduit: Backfill material above the conduit zone of direct burial conduit or above concrete envelope of concrete-encased conduit may be selected from the excavated material, if it contains no particles larger than 3 inches in diameter and is free from roots or debris. Imported material meeting these same requirements may be used in lieu of material from the excavation. Compact backfill in maximum 12-inch layers to at least 95 percent of the maximum density at optimum moisture content as determined by AASHTO T 180.

### 3.7 HANDHOLES

- A. Install handholes where shown on the Drawings. Provide excavation, shoring, bracing, backfilling, grading, etc., in accordance with requirements specified elsewhere in these Contract Documents.
- B. Do not install handholes until final conduit grading, including field changes necessitated by underground interferences, has been determined. Set frames to final grades as required.
- C. Make installation so that raceways enter handholes at nearly right angles and as near as possible to one end of a wall, unless otherwise indicated.
- D. Install one ground rod in each handhole. Connect all noncurrent-carrying metal parts in the handhole and any metallic raceway grounding bushings to this ground rod with No. 6 AWG (minimum) copper conductor.

### 3.8 WIREWAYS

- A. Mount wireways securely in accordance with the NEC and manufacturer's instructions. Locate removable cover or hinged cover on accessible vertical face of wireway unless otherwise indicated.



**3.9 PREPARATION FOR PULLING IN CONDUCTORS**

- A. Do not install crushed or deformed raceways. Take care to prevent the lodging of plaster, concrete, dirt, or trash in raceways, boxes, fittings, and equipment during the course of construction. Make raceways entirely free of obstructions or replace them. Ream all raceways, remove burrs, and clean raceway interior before introducing conductors or pull wires.
- B. Immediately after installation, plug or cap all raceway ends with watertight and dust-tight seals until the time for pulling in conductors.
- C. For concrete-encased raceways, after the concrete envelope has set, pull a mandrel of a diameter approximately 1/4 inch less than the raceway inside diameter, through each raceway. Then pull a bristle brush through each raceway to remove debris.

**3.10 EMPTY RACEWAYS**

- A. Certain raceways may have no conductors pulled in as part of this Contract. Identify with tags at each end and at any intermediate pull point the origin and destination of each such empty raceway. Where a raceway has been identified with a name (number) in a Raceway Schedule, use that name on the tag in lieu of origin and destination. Provide a removable permanent cap over each end of each empty raceway. Provide a nylon pull cord in each empty raceway.

**END OF SECTION**



# **SECTION 16120 CONDUCTORS - LOW VOLTAGE**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section covers the work necessary to furnish and install, complete, electrical conductor systems.

### **1.2 RELATED SECTIONS**

- A. See CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS, contain information and requirements that apply to the work specified herein.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate payment for the work in this section will be made. The payment for the work in this section will be included as part of the lump sum bid amount stated in the BID.

### **1.4 SUBMITTALS**

- A. Submittals shall be made in accordance with Division 1, GENERAL REQUIREMENTS, and Section ELECTRICAL - GENERAL PROVISIONS. In addition provide the following submittals:

### **1.5 CONDUCTOR IDENTIFICATION SYSTEM**

- A. Provide complete power and control conductor identification system so that after installation, circuits can be easily traced from origin to final destination.
- B. Identify power and control conductors with preselected circuit name at each termination and in all accessible locations such as handholes, panels, switchboards, pull boxes, terminal boxes, etc. For identification, use type of tags specified herein.
- C. Tag circuits by using the circuit name in the Circuit Schedule if given.
- D. For circuits that do not appear in the Circuit Schedules or if a circuit schedule is not given, assign a circuit name based on the device or equipment at the load end of the circuit. Where this would result in the same name being assigned to more than one circuit, add a number or letter to each otherwise identical circuit name to make it unique.
- E. Before tagging the circuits, submit a list of circuit names to the Engineer for approval prior to any use of that list. Include in this list circuit names not appearing in the Circuit Schedules, along with the same circuit information as is given for circuits in the Schedules if a schedule is given.

- F. Change any circuit name that the Engineer finds unacceptable.
- 1.6 CONDUCTOR COLOR CODING**

- A. Color coding of multiconductor control and instrumentation cable is specified in the individual cable type specification.
- B. For power conductors, provide all single conductors and individual conductors of multiconductor power cables with integral insulation pigmentation of the designated colors, except conductors larger than No. 6 AWG may be provided with color coding by wrapping the conductor at each end and at all accessible locations with vinyltape. Where this method of color coding is used, wrap at least six full overlapping turns of tape around the conductor covering an area 1-1/2 to 2 inches wide at a visible location.
- C. Phase A, B, C implies the direction of positive phase rotation.
- D. Use the following colors:

<u>System</u>	<u>Conductor</u>	<u>Color</u>
All systems	Equipment Grounding	Green
208Y/120 volts	Grounded neutral	White
3-phase, 4-wire, and circuits derived therefrom without transformation	Phase A	Black
	Phase B	Red
	Phase C	Blue
480Y/277 volts	Grounded neutral	White, Black Tracer
3-phase, 4-wire, and circuits derived therefrom without transformation	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow

**PART 2 PRODUCTS**

**2.1 GENERAL**

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

**2.2 CONDUCTORS**

- A. Conductors 600 Volts and Below:
  1. Unless otherwise indicated, provide stranded conductors, except provide solid conductors where No. 10 AWG and No. 12 AWG are designated for branch circuit power wiring in lighting and receptacle circuits.
  2. Utilize only conductors meeting applicable requirements of NEMA WC 3, WC 5, WC 7, and ICEA S-19-81, S-61-402, and S-66-524.

3. Provide conductors with Type THHN/THWN insulation, except for sizes No. 6 and larger, provide conductors with XHHW insulation.
4. Provide copper conductors. Unless noted otherwise, conductor sizes indicated are based on copper conductors. Do not provide conductors smaller than those indicated.
5. For direct burial conductors and cables, provide conductors with UL labeling "TYPE USE" and RHW insulation with heavy-duty, black, neoprene sheath meeting the physical requirements and minimum thickness requirements of ICEA S-19-81 and NEMA WC 3.
6. Where flexible cords and cables are specified, provide Type SO, 600 volt, with the number and size of copper conductors as required.

B. Conductors Accessories (Low Voltage):

1. Splices for No. 10 and smaller wire shall be self-insulated crimp connectors, Thomas & Betts Sta-Kon, Burndy Insulink, or equal. Splices and terminations for No. 8 and larger wire shall be wide range compression type, designed for installation with a dieless tool and shall be Square D VERSAtile connectors, or equal. Terminations for No. 10 and smaller wire shall be self-insulating crimp connectors, which lock to a screw head and shall be Thomas & Betts Sta-Kon Locking Spade, Burndy Vinylug Flanged-Fork-Tongue Terminal, or equal. Tools for installing the above connectors shall be designed for a complete, controlled crimp and shall not release until the connection is completed. Such tools shall be Thomas & Betts Shure-Stake, Burndy Hytool MR8, Square D VERSA-CRIMP tool, or equal.
2. Wire ties shall be Thomas & Betts Ty-Rap Cable Ties, or equal. Where wire or cord is exposed, Thomas & Betts Ty-Rap Lashing Ties, or equal, shall be used. Cords shall terminate in Thomas & Betts Liquid Tight Strain Relief Connectors, or equal. Where hubs would be required for cord connections Thomas and Betts Chase Liquid Tight Cord Connectors, or equal, shall be used.

C. Multi-Conductor Cable:

1. Provide cable that is UL listed Type TC and conforms to the requirements of UL 1277 and NEC Article 340, or UL listed Power Limited Circuit Cable that conforms to the requirements of Article 725 of the National Electrical Code. Provide cables permanently and legibly marked with the manufacturer's name, the maximum working voltage for which the cable was tested, the type of cable, and labeled UL (or submit evidence of UL listing).
2. Provide cables as specified under the type number in this section (Type 1, Type 2, etc.). Conduits shown on the Drawings and in the Circuit/Raceway Schedule have been sized to accommodate the outside diameter for each type. For this reason, use cable diameters equal to or less than the diameters specified.
  - a. Type 1 (600-Volt Multi-Conductor Control Cable, Type TC):
    - i. General: Multi-conductor control circuit interconnection cable with ground. Suitable for installation in open air, in cable trays, conduit, or other approved raceways. Minimum cable temperature rating 90 degrees C dry locations, 75 degrees C wet locations. Passes vertical tray flame test.
    - ii. Individual Conductors: No. 14 AWG, 7-strand copper.

- iii. Insulation and Jackets: Provide conductors having 15-mil PVC insulation with 4-mil nylon jacket, and UL listed as Type THHN/THWN. Color code the conductor group in accordance with ICEA S-61-402, Appendix K, Method 1, Table K-2. Include one full size green equipment grounding conductor. Bind conductor group with a spiral wrap of barrier tape. Provide cable with overall outer PVC jacket, which is flame-retardant, sunlight- and oil resistant, and has a nominal thickness as shown in the table below.
- iv. Use only 7-, 12-, 19- and 25-conductor cables. The green grounding conductor is included in the number of conductors shown in the table below.

<u>No. of Conductors</u>	<u>Max. Outside Diameter (inches)</u>	<u>Jacket Thickness (mils)</u>
7	0.48	45
12	0.65	60
19	0.76	60
25	0.93	60

- v. Manufacturers: The Okonite Company, Rome Cable, or approved equal.
- b. Type 3 (600-Volt No. 16 AWG Twisted, Shielded Pair Instrumentation Cable, Type TC):
  - i. General: Single pair instrumentation cable designed for noise rejection for process control, computer, or data log applications. Suitable for installation in cable trays, conduit, or other approved raceways. Minimum cable temperature rating shall be 90 degrees C dry locations, 75 degrees C wet locations.
  - ii. Individual Conductors: Bare soft annealed copper, Class B, 7-strand concentric per ASTM B 8; 20 AWG, 7-strand tinned copper drain wire.
  - iii. Insulation and Jacket: Each conductor 15-mil nominal PVC and 4-mil nylon insulation. Pair conductors pigmented black and red. Jacket flame-retardant and sunlight- and oil-resistant PVC with 45 mils nominal thickness. Shield 1.35-mil aluminum/mylar overlapped to provide 100 percent coverage.
  - iv. Dimension: 0.31 inch nominal OD.
  - v. Manufacturers: The Okonite Company, Alpha Wire Corporation, or approved equal.

**D. Conductor and Cable Tags:**

- 1. Tags relying on adhesives or taped-on markers are not acceptable.
- 2. Provide conductor tags for conductors No. 12 AWG and below with legible permanent sleeve of yellow or white PVC with machine printed black marking.
- 3. Provide tags for cables, and for conductors No. 10 AWG and larger, consisting of permanent nylon marker plates with legible designations hot stamped on the plate. Attach these marker plates to conductors and cables with nylon tie cord.

- E. Equipment Grounding Conductors:
  1. Provide stranded copper conductors, as indicated or as required by NEC, for equipment grounding.
  2. Provide conductors bare or with green covering.
- F. Direct Buried Grounding Conductors:
  1. Provide bare stranded copper conductors, size as indicated, for the ground system at transformers, switchgear, and where indicated.
  2. Copper-clad steel conductor of equivalent capacity and surface area may be substituted if accepted by the Engineer.
- G. Motor Conductors from VFD
  1. 600 V, 90°C XHHW2 as manufactured by Anixter, Belden, or equal.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii. Where pulling compound is used, use only UL listed compound compatible with the cable outer jacket and with the raceway involved.
- B. Wires shall be gripped either directly or by basket weave pulling grips. Pulling force shall not exceed 0.008 pounds per circular mill cross section. Pull around bends shall not exceed 300 pounds per foot of bend radius.
- C. Conductors shall not be bent tighter than a bending radius of eight (8) cable diameters.
- D. Tighten all screws and terminal bolts using torque type wrenches and/or drivers to tighten to the inch-pound requirements of the NEC and UL.
- E. Where single conductors and cables in handholes, junction boxes, and similar locations are not wrapped together by some other means such as are and fireproofing tapes, bundle throughout their exposed length all conductors entering from each conduit with nylon, self-locking, releasable, cable ties placed at intervals not exceeding 12 inches on centers.
- F. Run conductors as indicated on the Drawings, with no splices except as indicated or accepted by the Engineer.

### **3.2 CONDUCTOR 600 VOLTS AND BELOW**

- A. Provide conductor sizes indicated on Drawings.

- B. Wire nuts may be used on solid conductors of 120-volt lighting and receptacle circuits only. Place no more than one conductor in any single barrel pressure connector. Use crimp connectors with tools by same manufacturer and/or UL listed for connectors of all stranded conductors.
- C. Vinyl plastic insulating tape for wire and cable splices and terminations shall be flame retardant, 7-mil thick minimum, rated for 90°C minimum meeting the requirements of UL 510.
- D. Where conductors pass through holes or over edges in sheet metal, remove all burrs, chamfer all edges, and install bushings and protective strips of insulating material to protect the conductors.
- E. Arrange wiring in cabinets, panels, and motor control centers neatly cut to proper length, remove surplus wire, and braid and secure in an acceptable manner. Identify all circuits entering motor control centers or other control cabinets in accordance with the conductor identification system specified. herein.

### **3.3 JOINTS AND TERMINATIONS (LOW VOLTAGE)**

- A. All joints, splices, terminations, or other conductor connections shall be compression type, installed with an approved tool. Connections to motor terminals through 15 horsepower may be by rubber wrap cap. Connections to motor terminals above 15 horsepower shall be by tape insulated split bolt connectors. Wire up through No. 1/0 may be terminated directly in tubular clamps and set screw connectors, where provided by the manufacturer. Wire up through Size 14 may also be terminated in saddle clamps, where provided by the manufacturer. All other terminations shall be in a specified connector.
- B. Soldered mechanical joints will not be acceptable.
- C. Terminate control and instrumentation wiring with methods consistent with terminals provided, and in accordance with terminal manufacturer's instructions. Where terminals provided will accept such lugs, terminate all control and instrumentation wiring (except solid thermocouple leads) with insulated, locking-fork compression lugs, Thomas & Betts Sta-Kon, or equal.
- D. For terminals designed to accept only bare wire compression terminations, use only stranded wire, and terminate only one wire per terminal. Tighten all terminal screws with torque screwdriver to recommended torque values.
- E. Attach compression lugs with a tool specifically designed for that purpose which provides a complete, controlled crimp where the tool will not release until the crimp is complete. Use of plier type crimpers is not acceptable.
- F. For conductors that will be connected by others, provide at least 6 feet spare conductor in freestanding panels and at least 2 feet spare in other assemblies. Provide spare conductors in any particular assembly, where it is obvious that more conductors will be needed to reach the termination point.



**3.4 CABLES**

- A. Do not splice without permission of the Engineer. Locate splices, when permitted, only in readily accessible cabinets or junction boxes using terminal strips.
- B. Where connections of cables installed under this section are to be made under Section PROCESS INSTRUMENTATION AND CONTROL SYSTEM, leave pigtails of adequate length for neat bundled type connections.
- C. Maintaining the integrity of shielding of instrumentation cables is essential to the operation of the control systems. Take special care in cable installation to ensure that grounds do not occur because of damage to the jacket over the shield.
- D. Where conductors carrying both discrete and analog signals are run in the same item, such as a box or handhole, route analog and discrete conductors on the opposite side of the item, maintaining as much separation as possible.

**3.5 CONDUCTOR ARC AND FIREPROOFING TAPES**

- A. Use arc and fireproofing tapes on all 600-volt single conductors and cables except those rated Type TC at splices in all manholes, handholes, vaults, cable trays, and other indicated locations.
- B. Wrap together as a single cable all conductors entering from each conduit.
- C. Follow tape manufacturer's installation instructions. Secure the arc and fireproofing tape at frequent intervals with bands of the specified glass cloth electrical tape. Make each band of at least two wraps of tape directly over each other.

**3.6 FIELD TESTS**

- A. Conductors Under 600 Volts: Perform insulation resistance testing of all power and control circuits below 600 volts as required under Section ELECTRICAL - GENERAL PROVISIONS.
- B. Instrumentation Cable: After instrumentation cable installation and conductor termination per the recommendations of the instrumentation and control supplier, perform tests witnessed by the Engineer to ensure that instrumentation cable shields are isolated from ground, except at the grounding point. Remove all improper grounds.

**END OF SECTION**



# **SECTION 16450 GROUNDING**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- A. This section covers the work necessary to furnish and install, complete, the electrical grounding system.

### **1.2 RELATED SECTIONS**

- A. See CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this project.

### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate payment will be made for work in this section. The payment for the work in this section will be included as part of the lump sum bid amount stated in the BID.

### **1.4 REFERENCED STANDARDS**

- A. See Section ELECTRICAL - GENERAL PROVISIONS, which lists the standards that apply to the work specified herein.

### **1.5 SUBMITTALS**

- A. Submittals shall be made in accordance with Division 1, GENERAL REQUIREMENTS, and Section ELECTRICAL - GENERAL PROVISIONS .

## **PART 2 PRODUCTS**

### **2.1 GROUND RODS**

- A. Provide copper-clad steel ground rods not less than 3/4 inch in diameter, 10 feet long driven full length into the earth. Special requirements shall be as shown and as specified herein.

### **2.2 GROUND CONDUCTORS**

- A. Provide grounding conductors of the size shown and the type specified in Section CONDUCTORS.

## 2.3 GROUND CONNECTIONS

- A. For belowgrade connections, provide exothermic-welded type of connectors as manufactured by Cadweld, Thermoweld, or equal.
- B. For abovegrade connections, provide exothermic-welded, or compression type connectors.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. A green or bare equipment grounding conductor shall be run in each raceway. Such conductors shall be based on NEC Table 250-95 and sized for the highest overcurrent device protecting any conductor in that raceway. The equipment grounding conductors shall be electrically continuous from each piece of equipment to the service ground.
- B. Except where specifically indicated otherwise, ground all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems in strict accordance with the NEC, state, and other applicable laws and regulations.
- C. Where grounding conductors are shown, bond the wires to metallic enclosures at each end and to all intermediate metallic enclosures. Connect grounding conductors to all grounding bushings on raceways. Where any equipment contains a ground bus, extend and connect grounding conductors to that bus. Connect the enclosure of the equipment containing the ground bus to that bus. Run ground conductors inside conduits enclosing the power conductors.
- D. Where an equipment grounding means is not provided, make connections of any grounding conductors to motors 10 hp and above or circuits 20 amps or above by a solderless terminal and a 5/16-inch minimum bolt tapped to the motor frame or equipment housing. Ground connections to smaller motors or equipment may be made by fastening the terminal to a connection box. Connect junction boxes to the equipment grounding system with grounding clips mounted directly on the box or with 3/8-inch machine screws. Completely remove all paint, dirt, or other surface coverings at grounding conductor connection points so that good metal-to-metal contact is made.
- E. Install sufficient ground rods in addition to code required grounding so that resistance to ground as tested by standard methods does not exceed 1 ohm unless otherwise accepted. Where more than one rod is required, install rods at least 6 feet apart.
- F. Ground shields of any shielded power cable at each splice or termination in accordance with recommendations of the splice or termination manufacturer. Ground shields of any control cables in accordance with the details shown.

- G. Ground metal sheathing and any exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond any metal equipment platforms which support electrical equipment to that equipment. Provide good electrical contact between metal frames and railings supporting pushbutton stations, receptacles, instrument cabinets, etc., and raceways carrying circuits to these devices.
- H. Bond neutrals of transformers within buildings to the system ground network, and to any additional indicated grounding electrodes.

### **3.2 GROUNDING CONNECTIONS**

- A. Unless shown otherwise, make connections of grounding conductors to ground rods at the upper end of the rod with the end of the rod and the connection point below finished grade. Provide a capped well, formed of 4-inch PVC conduit, from grade to 2 inches below connection to ground rod, to allow for inspection.
- B. Make connections of grounding conductors accessible.
- C. In handholes, install ground rods with ends 4 to 6 inches above the floor with connections of grounding conductors fully visible and accessible.
- D. When making thermite welds, wire brush or file the point of contact to a bare metal surface. Use thermite welding cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly clean the joint. For compression connectors, use homogeneous copper, anti corrosion, surface treatment compound at connectors in accordance with connector manufacturer's recommendations. Use connectors of proper size for conductors and ground rods specified. Use connector manufacturer's compression tool. Notify Engineer prior to backfilling any ground connections.

### **3.3 FIELD TESTS**

- A. The Contractor shall test the resistance of the grounding electrode system by the fall-of-potential method. The Contractor shall supply a Biddle No. 6322 Earth Tester, or equal, and make the test in the presence of the Engineer with grounding conductors disconnected. If the grounding electrode test resistance exceeds 1 ohm, the Contractor shall add ground rods or other grounding electrodes to the grounding electrode system until the grounding electrode test resistance is 3 ohms or less. Methods which change soil resistivity are not acceptable as means of lowering the grounding electrode test resistance. This test shall not be made within 24 hours after rainfall.
- B. Test all ground fault interrupter (GFI) receptacles and circuit breakers for proper connection and operation with methods and instruments prescribed by the manufacturer.
- C. Provide copies of reports of all grounding system tests for inclusion in Operation and Maintenance Manuals and for review by the Engineer.

## **END OF SECTION**



# **SECTION 16483**

## **VARIABLE FREQUENCY CONTROLLERS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. This section provides specification requirements for furnishing, installing, and testing the adjustable frequency drives, variable speed drives or herein identified as AC Drives for use with NEMA B design AC motors.
- B. The AC Drive manufacturer shall furnish, field test, adjust and certify all installed AC Drives for satisfactory operation.

#### **1.2 RELATED SECTIONS**

- A. Section 11306 – Submersible Pumps
- B. Division 16 - Electrical

#### **1.3 MEASUREMENT AND PAYMENT**

- A. No separate payment shall be made for work under this section. All work shall be included in the lump sum bid price for the items to which it pertains.

#### **1.4 REFERENCES**

- A. The AC drive and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of IEC, UL, CUL, and NEMA.

#### **1.5 SUBMITTALS – FOR REVIEW/APPROVAL**

- A. The following information shall be submitted to the Engineer:
  - 1. Dimensioned outline drawing
  - 2. Schematic diagram
  - 3. Power and control connection diagram(s)
  - 4. Product data sheets.

- B. Where applicable, the following additional information shall be submitted to the Engineer:
  - 1. Connection details between close-coupled assemblies
  - 2. Composite front view and plan view of close-coupled assemblies
  - 3. Key interlock scheme drawing and sequence of operations

**1.6 SUBMITTALS – FOR CONSTRUCTION**

- A. The following information shall be submitted for record purposes:
  - 1. Final as-built drawings and information for items listed paragraph 1.5
  - 2. Installation information.
- B. The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

**1.7 QUALIFICATIONS**

- A. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- B. The supplier of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- C. The AFD manufacturer shall maintain, as part of a national network, engineering service facilities within 250 miles of project to provide start-up service, emergency service calls, repair work, service contracts, maintenance and training of customer personnel.
- D. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the BOCA National Building Code, paragraph 1612.6 or UBC Seismic Zone 4. As part of the VFD Submittal, a Seismic Study shall be supplied that documents the necessary bracing for proper seismic mounting of the equipment. The Seismic Study shall be provided by a third-party source that carries a PE stamp from an engineer in the state of SC.

**1.8 QUALITY ASSURANCE**

- A. The AC Drive and all associated optional equipment shall be UL listed according to Power Conversation Equipment UL 508C or UL 508A. A UL label shall be attached inside each enclosure as verification.



- B. The AC Drive shall be designed, constructed and tested in accordance with NEMA, NEC, VDE, IEC standards and CSA certified.
- C. All Drive door mounted pilot devices shall be tested to verify successful operation. Documentation shall be furnished to the Engineer.

**1.9 REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

**1.10 OPERATION AND MAINTENANCE MANUALS**

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instructions leaflets and instruction bulletins for the complete assembly and each major component.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. The AC Drive shall be provided by Eaton/Cutler-Hammer or equal by Rockwell Automation/Allen Bradley.
- B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

**2.2 CONSTRUCTION**

- A. Where shown on the drawings, adjustable frequency drives 1 through 25 horsepower (HP) shall have the following features:
  - 1. The AC Drive shall be rated 240V AC (optional input voltages of 208, 380, 480 and 575V AC). The AC Drive shall provide microprocessor-based control for three-phase induction motors.
  - 2. The AC Drive shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output.

3. Alternate control techniques other than pulse width modulated (PWM) are not acceptable.
4. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section. Bipolar Junction Transistors GTOs or SCRs are not acceptable.
5. The AC Drive shall have an efficiency at full load and speed that exceeds 95% for AC Drives below 15 Hp and 97% for drives 15 Hp and above. The efficiency shall exceed 90% at 50% speed and load.
6. The AC Drive shall maintain the line side displacement power factor at no less than 0.96, regardless of speed and load.
7. The AC Drive shall have a one (1) minute overload current rating of 150% and a two (2) second overload current rating of 250% for constant torque drives. The AC Drive shall have a one (1) minute overload current rating of 150% for variable torque drives. Coordinate required drive torque with Engineer for each application.
8. The AC Drive shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the AC Drive.
9. The AC Drive shall have a 3% nominal impedance integral AC three-phase line reactors.
10. The AC Drive shall also have a 3% nominal impedance integral DC link reactors.
11. The AC Drive shall be able to start into a spinning motor. The AC Drive shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AC Drive shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.
12. Standard operating conditions shall be:
  - a. Incoming power: Single or three phase as indicated on plans, 240V AC, +10% to -15%, and 50/60 Hz (+/-5 Hz) power to a fixed potential DC bus level
  - b. Frequency stability of +/-0.5% for 24 hours with voltage regulation of +/-1% of maximum rated output voltage
  - c. Speed regulation of +/- 0.5% of base speed
  - d. Load inertia dependant carryover (ride-through) during utility loss
  - e. Insensitive to input line rotation
  - f. Humidity: 0 to 95% (non-condensing and non-corrosive)
  - g. Altitude: 0 to 3,300 feet (1000 meters) above sea level
  - h. Ambient temperature: -10 to 50 degrees C (CT), -10 to 40 degrees C (VT)
  - i. Storage temperature: -40 to 60 degrees C.

13. The AC drive shall be capable of converting single phase incoming power to three phase output power. Provide additional capacitance kit and other accessories as necessary.
- B. Where shown on the drawings, adjustable frequency drives 26 through 1000 horsepower (HP) shall have the following features:
1. The AFD shall be rated for 240 Vac. The AFD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on 50 degree C ambient at 250HP and below and 40 degree ambient above 250HP VT and no less than a 3.6 kHz switching frequency to reduce motor noise and avoid increased motor losses. Drive shall have been tested to and UL listed as conforming to the requirements of UL508C at rated load currents and ambient temperature per this specification. Drive shall have a UL listed interrupting rating of 65kaIC.
  2. The AFD shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source AFD are not acceptable. Insulated Gate Bipolar Transistors (IGBT's) shall be used in the inverter section. Bipolar Junction Transistors, GTO's or SCR's are not acceptable. The AFD shall run at the above listed switching frequency.
  3. The AFD shall have an efficiency at full load and speed that exceeds 95%. The efficiency shall exceed 90% at 50% speed and load. The AFDs shall maintain the line side displacement power factor at no less than 0.96, regardless of speed and load.
  4. Provide a passive harmonics filter connected to the line side of the VFDs to limit input current distortion to 5% THD at full load and less than 8% at 30% load. Filter shall be housed within pump control panel.
  5. The AFD shall be able to start into a spinning motor. The AFD shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.
  6. Standard operating conditions shall be:
    - a. Incoming Power: Three phase, 480 Vac (+10% to -10%) and 60 Hz (+/-5 Hz) power is converted to a fixed potential DC bus level. Maximum input voltage unbalance shall be 0.5% as defined in NEMA MG 1 section 14.35.2
    - b. Frequency stability of +/-0.05% for 24 hours with voltage regulation of +/-1% of maximum rated output voltage.
    - c. Speed regulation of +/- 0.5% of base speed.
    - d. Load inertia dependant carry over (ride through) during utility loss.

- e. Insensitive to input line rotation.
  - f. Humidity: 0 to 95% (non-condensing and non-corrosive).
  - g. Altitude: 0 to 3,300 feet (1000 meters) above sea level.
  - h. Ambient Temperature: 0 to 50 °C.
  - i. Storage Temperature: -40 to 60 °C.
- C. The AC drive shall be mounted in NEMA Type 1 enclosures for drives mounted inside control panels, NEMA Type 12 enclosure for drives mounted indoors and NEMA Type 4X Stainless Steel for units mounted outdoors unless otherwise shown on drawings. The drive will be supplied with an externally operated lockable disconnect device. The enclosure shall be sized such that all required devices are mounted within the drive enclosure. No separate mounting of transformers, disconnects, line reactors, or trap filters will be allowed. Each drive shall be a self contained single unit unless specified as mounted in motor control center. Cooling fans and air filters shall be provided and placed such that the unit may be mounted against building walls on sides and back, or adjacent to other units without any air space requirements between the cabinets.
- D. A mechanical interlock shall prevent an operator from opening the AC drive door when disconnect is in the ON position. Another mechanical interlock shall prevent an operator from placing disconnect in the ON position while the AC drive door is open. It shall be possible for authorized personnel to defeat these interlocks.
- E. Provisions shall be provided for locking all disconnects in the off position with up to three padlocks.
- F. Current limiting fuses shall be installed and wired to the AC drive input.
- G. Provisions shall be made for accepting a padlock to lock the enclosure door.

### 2.3 MOTOR DATA

- A. The AC Drive shall be sized to operate the equipment as shown on the drawings and as specified herein. Manufacturer shall verify the Motor Horsepower, Full Load Amperes, RPM, Frequency, Voltage, and Service Factor with the equipment being furnished under separate sections within these specifications.

### 2.4 APPLICATION DATA

- A. The AC Drive shall be sized to operate a Variable Torque, Variable Torque Low Noise, Constant Torque, Constant Horsepower, or Impact load as required by the type of equipment being operated. Unit shall be sized to handle the hardest starting load for the type of equipment driven.

## 2.5 CONTROL FUNCTIONS

- A. Frequently access AC drive programmable parameters shall be adjustable for a digital operator keypad located on the front of the AC drive. Keypads must use plain English words for parameters, status, and diagnostics messages. Alphanumeric codes and tables are not acceptable.
- B. The user shall be able to control the Hand-Off-Auto position of the VFD through a switch located on the unit.
- C. The user shall be able to control VFD speed with the Local/Remote position of the VFD through a switch located on the unit.
- D. In Local mode, the user shall be able to control the motor speed through the potentiometer located on the unit.
- E. Variable frequency controllers shall be provided with Hand-Off-Auto switches.
- F. Graphical keypad
  - 1. Twelve (12) pushbuttons for selection, display, and modification of the AFD characteristics as follows:
    - a. Scroll left
    - b. Scroll right
    - c. Scroll up/increase
    - d. Scroll down/decrease
    - e. Parameter
    - f. Monitor
    - g. Page
    - h. Operate
    - i. Enter
    - j. Reset
    - k. Start
    - l. Stop
  - 2. The keypad LCD panel shall provide a choice of eight (8) lines of text or a 64x128 pixel graphical display of key waveforms or a combination of both.
  - 3. The operator shall be able to scroll through the keypad menu to choose between the following screens:
    - a. Monitor
    - b. Operate

- c. Parameter setup
  - d. Actual parameter values
  - e. Operating parameter trends
  - f. Menu for selection of parameters for graphical trend display
  - g. Active faults
  - h. Fault history
  - i. LCD adjustment
  - j. Info/files selection to indicate the standard software and optional features software loaded.
4. The Keypad and all door-mounted controls must be NEMA Type 12 rated.
- G. Standard advanced programming and troubleshooting functions shall be available by using a personal computer's RS-232 port and Windows® based software. In addition the software shall permit control and monitoring via the AFD's RS232 port. The manufacturer shall supply the required software.
- H. The following setups and adjustments, at a minimum, are to be available:
- 1. Start/stop command from keypad, remote or communications port
  - 2. Speed command from keypad, remote or communications port
  - 3. Motor rotation selection
  - 4. Maximum and minimum speed limits
  - 5. Acceleration and deceleration times, two settable ranges
  - 6. Critical (skip) frequency avoidance
  - 7. Torque limit
  - 8. Multiple attempt restart function
  - 9. Multiple preset speeds adjustment
  - 10. Catch a spinning motor start or normal start selection
  - 11. Programmable analog output
  - 12. DC brake current magnitude and time
  - 13. Proportional/integral process controller.

## 2.6 PROTECTION

- A. Upon power-up the AC Drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power and the pre-charge circuit.

- B. The AC Drive shall be UL 508C listed for use on distribution systems with 65,000A RMS available fault current. The Power Converter shall be able to withstand a short circuit current of 65,000 RMS symmetrical amperes as defined by NEMA ICS 7.1.09 and have the value listed on the AC Drive nameplate.
- C. The Power Converter shall be protected against short circuits, between output phases and ground; and the logic and analog outputs.
- D. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 5 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 600 seconds.
- E. The deceleration mode of the AC drive shall be programmable for normal and fault conditions. The stop modes shall include freewheel stop, fast stop and DC injection braking.
- F. Upon loss of the analog process follower reference signal, the AC drive shall fault and/ or operate at a user defined speed set between software programmed low speed and high-speed settings.
- G. The AC drive shall have solid state I<sup>2</sup>t protection that is UL listed and meets UL 508 C as a Class 10 overload protection and meets IEC 947. The minimum adjustment range shall be from 0.45 to 1.05 percent of the current output of the AC Drive.
- H. The AC Drive shall include Metal Oxide Varistors (MOVs) wired to the incoming AC Mains for phase to phase and phase to ground protection.

## **2.7 SYSTEM INTERFACES**

- A. Inputs – A minimum of six (6) programmable digital inputs, two (2) analog inputs and serial communications interface shall be provided with the following available as a minimum:
  - 1. Remote manual/auto
  - 2. Remote start/stop
  - 3. Remote forward/reverse
  - 4. Remote preset speeds
  - 5. Remote external trip
  - 6. Remote fault reset
  - 7. Process control speed reference interface, 4-20 mAdc
  - 8. Potentiometer and 1-10V DC speed reference interface
  - 9. RS232 programming and operation interface port

10. Serial communications port

B. Outputs – A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one (1) programmable analog output shall be provided, with the following available at minimum.

1. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:
  - a. Fault
  - b. Run
  - c. Ready
  - d. Reversing
  - e. Jogging
  - f. At speed
  - g. In torque limit
  - h. Motor rotation direction opposite of commanded
  - i. Overtemperature
2. Programmable open collector output with available 24V DC power supply and selectable with the following available at minimum:
  - a. Fault
  - b. Run
  - c. Ready
  - d. Reversing
  - e. Jogging
  - f. At speed
  - g. In torque limit
  - h. Motor rotation direction opposite of commanded
  - i. Overtemperature
3. Programmable analog output signal, selectable with the following available at minimum:
  - a. Output current
  - b. Output frequency
  - c. Motor speed
  - d. Motor torque
  - e. Motor power
  - f. Motor voltage
  - g. DC link voltage



## 2.8 MONITORING AND DISPLAYS

- A. The AC Drive display shall be a LCD type capable of displaying the following thirteen (13) status indicators:
1. Run
  2. Forward
  3. Reverse
  4. Stop
  5. Ready
  6. Alarm
  7. Fault
  8. Local
  9. Panel
  10. Remote
  11. Hand
  12. Auto
  13. Off.
- B. The AFD's display shall be capable of displaying the following monitoring functions at a minimum:
1. Output frequency
  2. Output speed
  3. Motor current
  4. Motor torque
  5. Motor power
  6. Motor voltage
  7. DC-link voltage
  8. Heatsink temperature
  9. Total operating days counter
  10. Operating hours (resettable)
  11. Total megawatt hours
  12. Megawatt hours (resettable)
  13. Voltage level of analog input
  14. Current level of analog input
  15. Digital inputs status
  16. Digital and relay outputs status

17. Motor temperature rise, percentage of allowable.

C. Protective Functions

1. The AFD shall include the following protective features at minimum:
  - a. Overcurrent
  - b. Overvoltage
  - c. Inverter fault
  - d. Undervoltage
  - e. Phase loss
  - f. Output phase loss
  - g. Undertemperature
  - h. Overtemperature
  - i. Motor stalled
  - j. Motor overtemperature
  - k. Motor underload
  - l. Logic voltage failure
  - m. Microprocessor failure
  - n. DC injection braking.
  - o. The AFD shall provide ground fault protection during power-up, starting, and running. AFDs with no ground fault protection during running are not acceptable.

D. Diagnostic Features

1. Fault History
  - a. Record and log faults.
  - b. Indicate the most recent first, and store up to 9 faults.

E. The VFD shall include the following operators on the VFD enclosure:

1. Pressure fail light
2. Motor temp light
3. VFD fault light
4. Reset pushbutton

**2.9 OPTIONAL FEATURES TO BE INCLUDED IN THE AFD:**

- A. HMCP or thermal magnetic breaker to provide a disconnect means. Operating handle shall be flange mounted. The disconnect shall not be mounted on the door.

The handle position shall indicate ON, OFF, and TRIPPED condition. The handle shall have provisions for padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent unauthorized opening or closing of the AFD door with the disconnect handle in the ON position. Door handle interlock can be defeated by qualified maintenance personnel.

- B. AC output contactor to provide a means for positive disconnection of the drive output from the motor terminals.
- C. Fused space heaters with thermostat for oversize enclosures to minimize condensation potential upon drive shutdown.
- D. Aluminum nameplate engraved with user's identifying name or number for oversize enclosures.
- E. 120 Vac control to allow AFD to interface with remote dry contacts.
- F. Dynamic braking control circuitry shall be provided to decelerate the motor faster than the internal losses can absorb. Dynamic braking shall cause an optional resistor bank, when specified; to be switched onto the DC link as required to absorb the regenerative energy. This shall allow the fastest controlled deceleration and/or stop without an over-voltage condition. The resistor bank, when specified, shall be located external to the drive enclosure to prevent overheating of the drive.
- G. Communication card for Ethernet/TCP interface with control system.
- H. Provide an input EMI filter to minimize conducted electrical noise to meet the requirements of IEC 61800-3.

## 2.10 HARMONIC ANALYSIS

- A. The harmonic distortion at the point of common coupling (PCC) shall be predicted through computer modeling of the distribution system and connected AC drives as specified. The PCC for voltage distortion shall be at the secondary of the 480 V distribution transformer and the PCC for the current distortion shall be at the primary of the 480 V transformer. These harmonic distortion values must not exceed 5% for voltage and those as listed in IEEE 519-1992, table 10.3 for current distortion. If the calculations determine that harmonic distortion values are higher than the voltage and current values specified, the drive manufacturer shall provide trap filters or other additional equipment to meet the intent of IEEE 519-1992 guidelines. This harmonic analysis report shall be part of the approval drawing process, submitted to the engineer for approval. Normal operation is defined as follows:

1. Utility transformer rating as determined by local utility and shown on drawings (if known). Manufacturer may choose to supply equipment such that the requirements of IEEE 519-1992 are met at the drive input terminals.
  2. All drives shown along with any future drives indicated operating simultaneously without any other linear loading applied
  3. Operating speed range: 50 to 100% speed range
  4. Point of common coupling: Load side of transformer (voltage), Line side of transformer (current)
- B. Where applicable, under emergency operating conditions the harmonic distortion at the point of common coupling (PCC) shall be predicted through computer modeling of the emergency generator system and connected ac drives as specified. The PCC for voltage distortion shall be at the generator load terminals. The harmonic voltage distortion value must not exceed the maximum permissible value specified by the generator manufacturer. The drive manufacturer shall coordinate with the manufacturer of the emergency generator specified in Section 16620 to obtain data for the harmonic analysis. If the calculations determine that harmonic distortion values are higher than the voltage specified, the drive manufacturer shall provide trap filters or other equipment as necessary to meet the generator manufacturer recommendations. Emergency operation is defined as follows:
1. Emergency Generator rating as specified in Section 16620
  2. All drives shown along with any future drives indicated operating simultaneously without any other linear loading applied
  3. Operating speed range between 50 and 100% of full speed
  4. Point of common coupling: Generator terminals

## **2.11 SPARE PARTS**

- A. Furnish under provisions of DIVISION 16 - GENERAL PROVISIONS.
- B. Provide two of each air filter.
- C. Provide three of each fuse size and type.
- D. A spare main logic board, keypad and power supply board shall be supplied for each different type of drive supplied under this specification.

## **PART 3 EXECUTION**

### **3.1 FACTORY TESTING**

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.
  - 1. All final assemblies shall be tested at full load on a dynamometer for a total run time of 2 hours minimum. The adjustable frequency drive shall trip electronically without device failure.
- B. The manufacturer shall provide three (3) certified copies of factory test reports.

### **3.2 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect and handle products to site under provisions of DIVISION 1 - GENERAL REQUIREMENTS.
- B. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

### **3.3 FIELD EXAMINATION**

- A. Verify that field measurements are as indicated on shop drawings and as instructed by manufacturer.
- B. Verify that the controller is of the correct size and voltage for the driven equipment.
- C. Verify that surface is suitable for controller installation.

### **3.4 PREPARATION**

- A. Verify that the location is ready to receive work and the dimensions are as indicated.
- B. Do not install AC Drive until the building environment can be maintained within the service conditions required by the manufacturer.
- C. Provide concrete housekeeping pad under the provisions of Section 03300 if unit is in a floor mounted or freestanding cabinet.

**3.5 INSTALLATION**

- A. Before and during the installation, the AC Drive equipment shall be protected from site contaminants.
- B. Installation shall be where indicated, in compliance with manufacturer's instructions, drawings and recommendations NEMA ICS 3.1.
- C. Tighten accessible connections and mechanical fasteners after placing controller.
- D. Install fuses in fusible switches.
- E. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- F. Provide engraved plastic nameplates under the provisions of DIVISION 16 - ELECTRICAL GENERAL PROVISIONS.
- G. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

**3.6 CLEANING**

- A. Touch up scratched or marred surfaces to match original finish.

**3.7 FIELD SERVICES**

- A. Provide the services of a qualified manufacturer's employed Factory Authorized Field Service Engineer to assist the Contractor in installation and start-up of the equipment specified under this section. Sales representatives will not be acceptable to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, installation as specified in manufacturer's installation instructions, wiring, application dependant adjustments, and verification of proper AFD operation.
- B. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative:
  - 1. Inspection and final adjustments
  - 2. Operational and functional checks of AFDs and spare parts
  - 3. The contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the AFD in accordance with those instructions.

- C. The Contractor shall provide three (3) copies of the manufacturer's field start-up report before final payment is made.

**3.8 MANUFACTURER'S CERTIFICATION**

- A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
- B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

**3.9 DEMONSTRATION AND TRAINING**

- A. The Contractor shall provide a training session to the Owner's representatives for 1 normal workday via 1 trip to the job site location determined by the Owner. Training and instruction time shall be in addition to that required for start-up service.
- B. The training shall be conducted by the manufacturer's qualified representative.
- C. The training program shall consist of the following:
  - 1. Instructions on the proper operation of the equipment
  - 2. Instructions on the proper maintenance of the equipment.

**3.10 MAINTENANCE SERVICE**

- A. The manufacturer shall furnish service and maintenance of all variable frequency controllers for one year from Date of Substantial Completion.

**END OF SECTION**

