

CONTRACT DOCUMENTS  
FOR

**Cobb County Water System**

**Noonday Creek Water Reclamation Facility  
Chemical Systems Upgrade**

CCWS Program No. T1023

**May 2018**

Prepared by:

**E**ngineering **S**trategies, **I**nc.  
3855 Shallowford Road, Suite 525  
Marietta, Georgia 30062  
(770) 429-0001

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**ADVERTISEMENT FOR BIDS**

**NOONDAY CREEK WATER RECLAMATION FACILITY**  
**CHEMICAL SYSTEMS UPGRADE**  
**PROGRAM NO. T1023**

for

**COBB COUNTY, GEORGIA**

Separate, sealed bids for furnishing all materials, labor, tools, equipment, and incidentals necessary for the construction of the aforementioned project will be received by **COBB COUNTY**, a political subdivision of the State of Georgia, herein referred to as "Owner", at the offices of the **Purchasing Department, 122 Waddell Street NE, Marietta, GA 30060**, until **12:00 Noon** (local time) on **June 14, 2018**. **No bids will be accepted after the 12:00 Noon deadline.**

The project name and program number ***MUST*** be shown on the outside of the sealed bid envelope. **Sealed bid labels** are included in the bid documents and must be affixed to both the outside of the sealed bid envelope and the shipping container, if applicable, even if it is a no-bid response.

Bids will be opened at 2:00 PM (local time) on **June 14, 2018, at the Purchasing Department, 122 Waddell Street NE, Marietta, GA 30060.**

A non-mandatory Pre-Bid Conference will be held for all Bidders at the Noonday Creek Water Reclamation Facility, 415 Shallowford Road, Kennesaw, GA 30144, on May 29, 2018 at 10:00 AM. Bidders will be given an opportunity to examine the project site at this meeting.

The Project involves demolishing existing chemical feed facilities and installing new chemical feed facilities and consists of the following major components:

1. Install temporary chemical feed facilities for the existing ferrous chloride, sodium hypochlorite, and sodium bisulfite chemical feed systems.
2. Demolish existing ferrous chloride feed system including bulk storage tanks, chemical feed pumps, control panels, chemical piping, electrical conduit and wiring, and appurtenances.
3. Demolish existing sodium hypochlorite feed system including bulk storage tanks, chemical feed pumps, control panels, chemical piping, electrical conduit and wiring, and appurtenances.
4. Demolish existing sodium bisulfite feed pumps, control panels, associated piping, and appurtenances.
5. Demolish other chemical pumps and appurtenances as specified.
6. Remove and replace existing chemical piping between bulk storage tanks and chemical feed building.
7. Remove and replace existing ferrous chloride, sodium hypochlorite, and sodium bisulfite distribution pipe between chemical feed building and discharge locations.
8. Install new ferrous chloride feed equipment including bulk storage tanks, peristaltic hose pumps, pump control panels, chemical piping, electrical conduit and wiring, and appurtenances.
9. Install new sodium hypochlorite feed equipment including bulk storage tanks, peristaltic hose pumps, pump control panels, chemical piping, electrical conduit and wiring, and appurtenances.
10. Install new sodium hydroxide peristaltic hose pump, pump control panel, chemical piping, electrical conduit and wiring, and appurtenances.
11. Install new sodium bisulfite peristaltic hose pumps, pump control panels, chemical piping, electrical conduit and wiring, and appurtenances.
12. Remove existing safety eyewash/shower stations and install new safety eyewash/shower stations.
13. Remove and dispose of two abandoned chemical storage tanks, in addition to tanks above.
14. Erosion and sediment control, site cleanup, and all other activities required to complete the project.

**All qualified contractors are invited to bid on this project; however, the Owner will adjudge qualification based on the “Bidder’s Statement of Qualifications” submitted with the bid. Only those bidders deemed qualified by the Owner will be considered for award. Bidders are required to have a State of Georgia Utility Contractor License.**

The Cobb County Purchasing Department has inaugurated an e-procurement system for electronic bid solicitation and bid responses thru BidNet’s Georgia Purchasing Group. The Instruction to Bidders, form of Bid, form of Contract, Drawings, Specifications, forms of Bid Bond, Performance Bond, and Payment Bond, and other Contract Documents are available for viewing and download on the BidNet’s Georgia Purchasing Group website at no charge.

The above-listed documents are also available for a non-refundable fee of **\$75.00** payable by check or money order at the offices of **Engineering Strategies, Inc. (ESI), 3855 Shallowford Road, Suite 525, Marietta, Georgia 30062**. To purchase a set of bid documents, call (770) 429-0001.

Bids will be accepted only from Bidders who are listed on the Plan Holders List, signifying that they have purchased a set of documents from the Cobb County Water System or they have acquired the bid documents through the Bidder’s registered account with BidNet’s Georgia Purchasing Group.

Each bid must be accompanied by a bid bond prepared on accepted form, duly executed by the bidder, in the amount of five per cent (5%) of the bid.

Owner reserves the right to waive any informality or to reject any or all bids, to evaluate bids, and to accept any bid which in its opinion may be for the best interest of Owner. Any bids submitted that do not include a duplicate of Section 00 41 13 and a copy of the bid bond as specified in the Instructions to Bidders may be rejected. Owner has the right to add to and delete from the contract once it has been awarded. Award, if award is made, will be to the lowest responsive, responsible bidder.

The successful bidder for this contract will be required to furnish a satisfactory performance bond and labor and material payment bond, each in the amount of one-hundred percent (100%) of the bid.

No bidder may withdraw his bid within 60 days after the actual date of the opening thereof.

**\*\* END OF SECTION \*\***

# SEALED BID LABELS

## SEALED BID ENCLOSED

DELIVER TO:

Cobb County Purchasing Department  
122 Waddell Street, NE  
Marietta, GA 30060

---

PROJECT NAME NOONDAY CREEK WRF CHEMICAL SYSTEMS UPGRADE

PROGRAM NO. T1023

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

**BIDS MUST BE RECEIVED BEFORE 12:00 NOON ON THE DATE OF THE BID OPENING**

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

ADDRESS: \_\_\_\_\_

\*\*\*\*\*

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DELIVER TO:

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PROJECT NAME NOONDAY CREEK WRF CHEMICAL SYSTEMS UPGRADE

PROGRAM NO. T1023

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

**BIDS MUST BE RECEIVED BEFORE 12:00 NOON ON THE DATE OF THE BID OPENING**

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

ADDRESS: \_\_\_\_\_

SECTION 00 21 13  
INSTRUCTIONS TO BIDDERS

**1. RECEIPT AND OPENING OF BIDS**

**COBB COUNTY**, a political subdivision of the State of Georgia, herein called the "Owner", invites bids on the form attached hereto, all blanks of which must be appropriately filled in. Bids from Bidders included on the Cobb County Water System's Plan Holders List will be received by the Owner at the offices of the **Purchasing Department, 122 Waddell Street NE, Marietta, GA 30060**, on the date and at the time indicated on the Advertisement for Bids. After such time on the same day, bids will be publicly opened and read aloud. Bids received after the designated time will not be considered.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 60 days after the actual date of the opening thereof.

**2. PREPARATION OF BID**

Each bid must be submitted on the prescribed form, prepared and provided by the Owner. All blank spaces for bid prices must be filled, in with ink. All required enclosed certifications must be fully completed and executed when submitted.

Each bid must be submitted in a sealed envelope, addressed to the Owner. The following information must be clearly displayed on the exterior of the envelope utilizing one of the **sealed bid labels** found in Section 00 11 13, *Advertisement for Bids*:

Project name and program number  
Date  
The name of the Bidder and his address.

If forwarded by mail or delivery service, the sealed envelope containing the bid must be enclosed in another shipping container (envelope or box) addressed as specified in the bid forms. The second **sealed bid label** provided must be affixed to the outside of the shipping container, as well.

Any and all bids not meeting the aforementioned criteria for bid submittal, will be declared non-responsive, will be returned to the Bidder unopened.

**Each bidder is required to submit a duplicate of Section 00 41 13 and a copy of their bid bond (with each page clearly marked as duplicate) with the original bid documents. Failure to provide a duplicate may result in the bid being considered non-responsive.**

**3. METHOD OF BIDDING**

The unit or lump sum price of each of the items in the bid shall include the actual cost to perform the work item and the item's pro rata share of overhead and profit so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price represents the total bid. Any bid not conforming to this requirement, such as unit prices which in the opinion of the Owner do not represent a reasonable cost for the work, will be considered unbalanced. Unbalanced bids may be rejected at the discretion of the Owner.

A bid in which a unit or lump sum price for an item is not entered, or for which a unit price of \$0.00 is entered, will be regarded as non-responsive and the bid will be rejected.

Bid prices shall include everything necessary for the completion of the work including, but not limited to, providing the materials, equipment, tools, plant and other facilities, and the management,

superintendence, labor and services. Bid prices shall include allowance for Federal, state and local taxes.

In the event that the product of a unit price and an estimated quantity does not equal the extended amount quoted, the unit price shall govern, and the correct product of the unit price and the estimated quantity shall be deemed to be the amount bid. If the sum of two or more items in the bid schedule does not equal the total amounts quoted, the individual item amounts shall govern and the correct total shall be deemed to be the amount bid.

Bidders must satisfy themselves as to the accuracy of the estimated quantities in the bid schedule by examination of the site and a review of the drawings and specifications including any addenda. After bids have been submitted, the Bidder shall not assert that there has been any misunderstanding concerning the quantities of work or of the nature of the work to be done.

The quantities listed in the unit price bid form shall be considered as approximate and will be used only for comparison of bids. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the Contract, and it is understood that the quantities may be increased or decreased as provided in the General Conditions without in any way invalidating the unit bid prices.

#### **4. MODIFICATION OR WITHDRAWAL OF BIDS**

A submitted bid may be retrieved in person by a bidder or its authorized representative if, before the scheduled closing time for receipt of bids, the identity of the persons requesting retrieval is established and that person signs a receipt for the bid. If the bid is retrieved for modification, the sealed bid must be resubmitted prior to the scheduled closing time for receipt of bids. If the bid is not resubmitted, it will be considered as withdrawn.

#### **5. ADDENDA**

Each bid schedule shall include specific acknowledgment in the space provided of receipt of all addenda issued by the Owner during the bidding period. Failure to so acknowledge may result in the bid being rejected as non-responsive.

#### **6. LAND ACQUISITION**

The Work on this Project is to be performed on property owned and easements acquired by the Owner and within public road right-of-way.

Pursuant to the requirements of OCGA § 36-91-20(b)(4)(B), detailed information on project specific easements can be found in the Special Conditions of the Bid (Section 00 41 13).

#### **7. BID GUARANTY**

Each bid must be accompanied by cashier's or certified check payable to the Owner, or a bid bond attached hereto, duly executed by the bidder as principal and issued by a surety listed in the latest issue of U.S. Treasury Circular 570, registered in the State of Georgia, and approved by the Owner in the amount of not less than five percent (5%) of the total amount of the base bid, as a guarantee that the Bidder will enter into a Contract and furnish bonds and evidence of insurance coverage, within twenty-one days after the issuance of the Notice of Award of the Contract to him. Such checks or bid bonds will be returned to all bidders except the lowest bidder after tabulation of bids.

The successful Bidder, upon his failure or refusal to execute and deliver the Contract, bonds and evidence of insurance coverage required within twenty-one days after the issuance of the Notice of Award of the Contract to him, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his bid.

## 8. MISTAKES; CORRECTIONS AND WITHDRAWAL OF BIDS

After bids are opened, if the low Bidder claims a serious and honest error in bid preparation, and can support such claim with evidence satisfactory to the Owner, withdrawal of the bid will be permitted. As a condition of this release, the low bidder will be prohibited from:

- A. Subcontracting or furnishing labor or equipment on this project.
- B. Bidding on any Cobb County Water System projects within ninety (90) days of release by Owner.

## 9. INTERPRETATIONS

No interpretation of the meaning of the drawings, specifications or other pre-bid documents will be made to any Bidder orally. Every request for such interpretation should be in writing, addressed to the Owner, and in order to be given consideration must be received by the close of business on the Tuesday one week prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the bid. All addenda so issued shall become a part of the Contract Documents.

Any questions concerning this bid should be directed in writing via letter, facsimile, or email to:

Mr. Joe Tommie, CPPO  
Purchasing Director  
Cobb County Purchasing Department  
122 Waddell Street NE  
Marietta, GA 30060  
FAX: (770) 528-8428  
[purchasing@cobbcounty.org](mailto:purchasing@cobbcounty.org)

and Mr. Eric W. Olson, P.E.  
Manager, Engineering & Records Div.  
Cobb County Water System  
660 South Cobb Drive  
Marietta, GA 30060-3105  
FAX: (770) 419-6335  
[eric.olson@cobbcounty.org](mailto:eric.olson@cobbcounty.org)

With copy to:  
Rita Neely, P.E.  
Project Engineer  
Cobb County Water System  
660 South Cobb Drive  
Marietta, GA 30060-3105  
FAX: (770) 419-6335  
[rita.neely@cobbcounty.org](mailto:rita.neely@cobbcounty.org)

## 10. SITE EXAMINATION

The site of the proposed work is shown on the drawings. The Bidder, before making his bid, shall examine the drawings, specifications and the site and shall make such examinations on the ground as may be necessary to thoroughly familiarize himself with the nature and extent of the proposed construction and with all local conditions affecting the work. The Bidder shall also accept the premises in its present condition and carry out all work in accordance with the requirements of the specifications and as shown on the drawings. The Owner will not be responsible for Bidder's errors and misjudgment nor for failure to obtain any information on local conditions or general laws or regulations pertaining thereto.

A non-mandatory Pre-Bid Conference will be held for all Bidders at the Noonday Creek Water Reclamation Facility, 415 Shallowford Road, Kennesaw, GA 30144, on May 8, 2018 at 10:00 AM. Bidders will be given an opportunity to examine the project site at this meeting.

At the time of the opening of bids, each Bidder will also be presumed to have read and to be thoroughly familiar with the drawings, Contract Documents (including all addenda) and the construction specifications. The failure or omission of any Bidder to examine any form, instrument or document shall in no way relieve any Bidder from any obligation in respect to his bid.

## 11. NOTICE OF SPECIAL CONDITIONS

Attention is particularly called to those parts of the Contract Documents and specifications which deal with the following:

- A. Insurance requirements
- B. Surveys, permits and regulations

The Federal and state regulations herein referred to supersede all conflicting requirements of the Contract Documents.

## 12. LAWS AND REGULATIONS; LICENSING

The Bidder's attention is directed to the fact that all applicable Federal and state laws, county and municipal ordinances and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

The State of Georgia has requirements for the licensing of contractors engaged in specific types of construction, including electrical, plumbing, and underground utility work [re: OCGA § 43-14]. Any contractor (or subcontractor of any tier) performing regulated work on this project shall furnish proof of valid and current registration to the Owner. Similarly, the State requirements concerning local business licenses shall be met (see also Section 00 73 17 of these documents).

## 13. STATUS OF PERMITS

The following status of permits related to this project is presented pursuant to the requirements of OCGA § 36-91-20(b)(4)(A).

- A. Refer to the Special Requirements (Section 00 73 17) for the status of permits for which the Owner is responsible.
- B. The Contractor is responsible for obtaining any necessary building permits or individual trade permits from the Cobb County Community Development Department. Contact the Development and Inspections Division at (770) 528-2039 for further information.
- C. Other permits necessary for construction shall be the full responsibility of the Contractor. These may regularly include, but not limited to:
  - Cobb County Trenching and Excavation Permit
  - Cobb County Department of Transportation Lane Closure / Road Closure Permit
  - Cobb County and State of Georgia permits associated with the use of explosives (blasting)

## 14. NON-COLLUSION AFFIDAVIT

The Georgia statute concerning public works construction contracting requires that any person who procures such work by bidding or proposal shall make an oath in writing that he/she has not prevented or attempted to prevent competition in such bidding. [OCGA § 36-91-21(d),(e)]. Pursuant to this requirement, the Bidder shall submit before commencing work, an executed copy of the Non-Collusion Affidavit form included in Section 00 45 19, completed by all persons materially involved in the procurement on this project. If the Bidder is a partnership, all of the partners and any officer, agent, or other person who may have represented or acted for them in bidding for or procuring the contract shall make the oath and complete the Affidavit. If the Bidder is a corporation, all officers, agents, or other persons who may have acted for or represented the corporation in bidding for or procuring the contract shall make the oath and complete the Affidavit. If such oath is false, the Contract shall be void, and all sums paid by the County on the Contract may be recovered by appropriate action.

## 15. GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT

The Georgia Security and Immigration Compliance Act (O.C.G.A. § 13-10-91) requires that contractors who enter into a contract for physical performance of services for a political subdivision of the state must register and participate in the federal work authorization program to verify employment eligibility of all newly hired employees. Further Contract provisions regarding this Act are included herein as Section 00 45 49.

**The Contractor Affidavit and Agreement (See Section 00 45 49), signed and notarized by the Bidder, must be submitted with the Bid. Bids received without an executed affidavit will be deemed non-responsive and will be disqualified from further consideration.**

## 16. EXECUTION OF BID DOCUMENTS

The Contractor, in signing his bid on the whole or any portion of the work, shall conform to the following requirements:

- A. Bids which are not signed by individuals providing said bid shall have attached thereto a power of attorney evidencing authority to sign the bid in the name of the person for whom it is signed.
- B. Bids which are signed for a partnership shall be signed by all of the partners or by an attorney-in-fact. There should be attached to the bid a power of attorney executed by the partners evidencing authority to sign the bid.
- C. Bids which are signed for a corporation shall have the correct corporate name thereof and the signature of the president or other authorized officer of the corporation manually written below the corporate name following the wording "By \_\_\_\_\_." The corporate seal shall also be affixed to the bid.

## 17. METHOD OF AWARD

The Contract will be awarded to the responsive, responsible Bidder submitting the lowest base bid complying with the conditions of the invitation to bid. Award will be made on the basis of the prices given in the base bid (not including alternates). Alternates may be awarded at the discretion of the Owner. The Bidder to whom the award is made will be notified at the earliest possible date following Board of Commissioners approval. The Owner 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 best interest.

A responsive Bidder shall be one who submits his bid in the proper form without qualification as called for in the specifications and on the Contract Drawings; and who binds himself on behalf of his bid to the Owner with the proper bid bond or certified check completed and attached; and who properly completes all forms required to be completed and submitted at the time of the advertised bid opening.

A responsible Bidder shall be one that has the capability in all respects to perform fully and reliably the contract requirements. The responsibility of the Bidder will be adjudged by the Owner based on the information presented in the Contractor's Statement of Qualifications. If the solicitation for this project is limited to Pre-qualified Cobb County Water System Contractors, the Statement of Qualification information on file is used in the evaluation of responsibility. If a Statement of Qualification is included as part of the bidding documents for this project, the form and all attachments must be properly completed and submitted with the Bid.

## 18. DISADVANTAGED BUSINESS ENTERPRISES (DBE) PARTICIPATION

Cobb County Government encourages the participation of all businesses in offering their services and/or products. The Cobb County Government has the goal to fairly and competitively procure the best product at the most reasonable cost.

A Disadvantaged Business Enterprise (DBE) is generally defined as a Female, Black American, Hispanic American and any other minority owned business. The Federal Government has long had a program in place to ensure participation of DBE vendors and suppliers on federally-funded contracts. The State of Georgia has established a similar program whereby DBE firms are defined, certified, and made known. This effort is managed by the Georgia Department of Transportation (GDOT). Additional information regarding this State program can be found at <http://www.dot.state.ga.us/doingbusiness/dbePrograms/Pages/default.aspx>.

While the Cobb County Government does not administer a DBE certification program, the County does desire to identify DBE participation in our contracts and to quantify that participation. The Bidder is requested to advise of DBE status (if any) by completing the *Disadvantaged Business Enterprise (DBE) Identification Form* in Section 00 41 13 of these Documents and to report the participation of any DBE subcontractors (See Section 00 45 53 and Section 00 73 18).

## **19. CONTRACT PERFORMANCE BOND AND PAYMENT BOND**

The Contractor will be required to furnish a contract performance bond and a payment bond executed by a surety company listed in the latest issue of U.S. Treasury Circular 570, registered and duly authorized to do business in the State of Georgia, and signed (or countersigned) by a local agent, each in an amount that is at least equal to one-hundred percent (100%) of the Contract Price, as security for the faithful performance of this contract and as security for the payment of all persons performing labor and furnishing material in connection with the Contract.

The surety shall be acceptable to the Owner and the bond shall be executed on the form attached. In case of default on the part of the Contractor, all expenses incident to ascertaining and collecting losses under the bond, including both engineering and legal services, shall lie against the bond.

The Contractor will be required to provide the Owner a one-year guarantee covering workmanship and materials of the project. The contract performance bond shall remain in force for one year from date of acceptance by the Owner. The cost of this bond shall be paid by the Contractor.

## **20. INSURANCE PROOF OF COVERAGE**

Prior to execution of Contract Documents, a certificate of insurance will be required as outlined in Section 00 73 16 of these specifications, Insurance Requirements for Contractors.

## **21. AWARD OF CONTRACT**

The Bidder to whom the Contract is being awarded will be required to execute the agreement, accompanying affidavits and forms, and obtain the performance bond, payment bond and insurance within twenty-one (21) calendar days from the date when the notice of award is issued to the Bidder. In case of failure of the Bidder to execute the agreement, affidavits and forms, and furnish the required bonds, the Owner may consider the Bidder in default, in which case the bid bond or check accompanying the bid shall become payable to the Owner.

**\*\* END OF SECTION \*\***

SECTION 00 41 13

BID

MADE TO: COBB COUNTY BOARD OF COMMISSIONERS  
COBB COUNTY WATER SYSTEM  
660 SOUTH COBB DRIVE  
MARIETTA, GA 30060-3105

PROGRAM NAME: **NOONDAY CREEK WATER RECLAMATION FACILITY  
CHEMICAL SYSTEMS UPGRADE**  
PROGRAM NUMBER: **T1023**

The undersigned, as **Bidder**, hereby declares that the only person or persons, company or parties interested in this Bid is or are named herein; and that this Bid is made without connection with any other person, company or parties making bid; and that it is in all respects fair and in good faith, without collusion or fraud.

The **Bidder** further declares that he has carefully examined the site of the work, has read and understands the plans, specifications and Contract Documents relative thereto, and has read all special provisions and addenda furnished prior to the opening of proposals; and the Bidder further declares that he has informed himself fully in regard to all conditions and requirements pertaining to the work.

The **Bidder** proposes and agrees, if this Bid is accepted, to enter into agreement with the Owner in the form of the Contract specified and to furnish all materials, labor, tools, equipment and incidentals necessary to complete the work in full and in accordance with the shown, noted, described and reasonably intended requirements of the Contract Documents.

**Bidder** accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of bid security. The Bidder agrees that, at the time of signing the Contract, he will furnish the performance bond and payment bond in the forms attached hereto, each in the amount of one-hundred percent (100%) of the Contract Price. Bidder will also furnish all of the required insurance certificates.

The undersigned agrees, unless hereinafter stated otherwise, to furnish all materials shown and specified in the plans, specifications and Bid Schedule.

*THE REMAINDER OF THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY*

Name of Bidder: \_\_\_\_\_

**PART 1 – BID SCHEDULE**

**NOONDAY CREEK WATER RECLAMATION FACILITY  
CHEMICAL SYSTEMS UPGRADE  
PROGRAM NO. T1023**

All Bid items shall include costs for furnishing to Owner all materials, equipment and supplies and for all costs incurred in completing the Work including design services and the installation of all materials, equipment and supplies furnished, complete in place and ready for continuous service, all other labor, permit fees, taxes, insurance, miscellaneous costs, overhead and profit.

<b>Item No.</b>	<b>Description</b>	<b>Total Price</b>
1.	Noonday Creek Water Reclamation Facility Chemical Systems Upgrade, complete, in accordance with the work described in the Contract Documents.	\$
2.	Extra Work Allowance, for additional work as directed by the Owner. No payments shall be made to the Contractor for extra work unless specific work items are negotiated and authorized by the Owner. Allowance in the amount of:	\$ 100,000.00

TOTAL BASE BID, ITEMS 1 THROUGH 2, INCLUSIVE: \$ \_\_\_\_\_

**TOTAL BASE BID, IN WORDS:**

\_\_\_\_\_ **DOLLARS**

Name of Bidder: \_\_\_\_\_

## PART 2 – BASE BID MAJOR EQUIPMENT ITEMS

The Total Bid in Part 1 shall include the costs for the circled Manufacturers/Suppliers listed in the Major Equipment Schedule, exclusive of any alternate bid items.

The Major Equipment Schedule lists the base bid equipment manufacturer/supplier as applicable for major equipment items and key suppliers for the Noonday Creek Water Reclamation Facility Chemical Systems Upgrade project. The Bidder must indicate which named manufacturer/supplier of major equipment it intends to provide by circling one of the manufacturers/suppliers listed. Listed equipment suppliers must meet the terms and conditions and technical requirements of the Contract.

If Bidder does not circle one of the equipment manufacturers/suppliers for each piece of major equipment, the Owner will select the manufacturer/supplier that is to be provided. No adjustments will be made to Total Base Bid if Owner is required to make selection.

<b>Major Equipment Schedule</b>		
<b><i>Specification Section Number</i></b>	<b><i>Equipment Description</i></b>	<b><i>Manufacturer/ Supplier</i></b>
43 41 43	Polyethylene Storage Tanks	Assmann Corporation of America  Poly Processing Company  Snyder Industries, Inc.
43 41 45	Fiberglass Reinforced Plastic Storage Tanks	Augusta Fiberglass  Belco Manufacturing Co., Inc.  L.F. Manufacturing, Inc. (LFM)
46 33 44	Hose Pumps	Verderflex  Watson Marlow, Inc.

Name of Bidder: \_\_\_\_\_

### **PART 3 – BIDDER'S STATEMENT OF QUALIFICATIONS**

#### **NOONDAY CREEK WATER RECLAMATION FACILITY CHEMICAL SYSTEMS UPGRADE PROGRAM NO. T1023**

##### **GENERAL**

- A. Any contractor who wishes to bid on the Noonday Creek Water Reclamation Facility project is required to complete this *Bidder's Statement of Qualifications* regardless of whether the firm has previously prequalified for other treatment plant projects for the Cobb County Water System.
- B. The completed *Statement* and all associated documents must be submitted with the bid and no later than the time and date instructed in Section 00 11 13, Advertisement for Bids. Bids received without the *Statement* will be rejected.
- C. The *Statement* shall be filled out in full by typing or in legible hand lettering in ink. All sections included in this package must be submitted. Any additional pages attached to the *Statement* must include the applicant's name, project name and number, and cross references to item numbers on the application form.
- D. The *Statement* will be evaluated on the basis of the information presented, and on an analysis of other publicly available information. The Owner and/or the Engineer may conduct such investigations or interviews as they deem necessary to assist in the evaluation of any proposal submitted and to establish to Cobb County's satisfaction the responsibility, qualifications, and financial ability of any prospective bidder.
- E. In determining the Contractor's qualifications and evaluating the *Statement*, the following factors will be considered:
  - Evidence of appropriate relevant construction experience of personnel in the key staff positions noted on the prequalification statement.
  - Satisfactory completion, with a focus on the last ten years, of construction projects of comparative scope and contract value to this project.
  - Client references.
  - Ability to perform the work.
  - Acceptable safety record with a focus on the last three years.

Name of Bidder: \_\_\_\_\_

**PART 3 – BIDDER'S STATEMENT OF QUALIFICATIONS**

**NOONDAY CREEK WATER RECLAMATION FACILITY  
CHEMICAL SYSTEMS UPGRADE  
PROGRAM NO. T1023**

**QUALIFICATIONS**

1. Provide the names, titles and resumes of key personnel who will be assigned to this project. Key personnel include: Principal-in-Charge, Project Manager, and Project Superintendent. Resumes should outline the qualifications of the project personnel who will perform key functions. Minimum information to be contained on the resume of each individual shall include: technical experience, managerial experience, education, dates of relevant assignments, position occupied on each assignment, description of duties on each assignment, occupational training and certification, trade societies and affiliations, and number of years with the organization. The personnel identified in the Application will be construed as committed for the duration of the project, unless changes are approved by the Cobb County Water System.
2. Submit information regarding the Bidder's experience (using the attached *Form for Similarly Scoped Projects and References*) for a minimum of three projects completed by your firm over the last ten years that most closely resemble the previously described project. Highlight projects that involved construction activities within or adjacent to an operating wastewater or water treatment plant. The information provided on these forms will be used to evaluate your organization's ability to perform the work described in a timely manner. One *Form for Similarly Scoped Projects and References* shall be completed for each project, using the blank form attached at the end of the *Bidder's Statement of Qualifications*. Supplemental information in other formats may also be attached if desired, but only in addition to the *Form*.
3. List all companies, firms, or organizations that own any part of your organization:  
  
\_\_\_\_\_  
  
\_\_\_\_\_
4. How many persons does your company permanently employ? \_\_\_\_\_
5. How many years of experience in the proposed type and size of construction work has your organization had: \_\_\_\_\_
6. Has the Bidder been assessed liquidated damages on any project in the past five years?  
Yes: \_\_\_\_\_ No: \_\_\_\_\_  
  
➔ *If Yes, attach a separate sheet with a detailed explanation.*

Name of Bidder: \_\_\_\_\_

**PART 3 – BIDDER'S STATEMENT OF QUALIFICATIONS**

**NOONDAY CREEK WATER RECLAMATION FACILITY  
CHEMICAL SYSTEMS UPGRADE  
PROGRAM NO. T1023**

7. Safety Information: Provide the Average Lost Workday Incident Rates, Average Recordable Incident Rates, and Experience Modification Rates for the past three years in the spaces provided below. Use only data from construction operations (not home office staff) in calculations.

a. Average Lost Workday Incident Rate (LWIR):

$$LWIR = \frac{\text{Total Number of Lost Workday Incidents} \times 200,000}{\text{Total Employee Hours Worked}}$$

Year	No. of Lost Workday Incidents	Total Employee Hours Worked	Lost Workday Incident Rate
20__			
20__			
20__			

b. Average Recordable Incident Rate (RIR):

$$RIR = \frac{\text{Total Number of Recordable Incidents} \times 200,000}{\text{Total Employee Hours Worked}}$$

Year	No. of Recordable Incidents	Total Employee Hours Worked	Recordable Incident Rate
20__			
20__			
20__			

c. Experience Modification Rate (EMR):

Year	Experience Modification Rate
20__	
20__	
20__	

d. Has the Bidder received any OSHA violations (citations) in the past five years?

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

→ *If Yes, attach a separate sheet describing the citations, including information about the dates of the citations, the nature of the violation, the project on which the citation was issued, the amount of penalty paid, if any. This question must be answered "Yes" and information provided if citations have been appealed or contested, but have not yet been resolved. If the citation was appealed and a decision has been issued, state the case number and the date of the decision.*

Name of Bidder: \_\_\_\_\_

**PART 3 – BIDDER'S STATEMENT OF QUALIFICATIONS**

**NOONDAY CREEK WATER RECLAMATION FACILITY  
CHEMICAL SYSTEMS UPGRADE  
PROGRAM NO. T1023**

8. Has the Bidder been involved in claims, arbitration, mediation, and lawsuits on public works projects, as a plaintiff, defendant or participant, in the last five years?

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

➔ *If Yes, attach a separate sheet listing the name of the claim, the nature of the claim, when and where filed, status, final disposition if resolved, and the name and location of the project.*

9. Does the Bidder (including any member, officer, partner, subsidiary or affiliate thereof) have a pending citation for violating any provision of The Official Code of Cobb County, Georgia at the current time?

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

➔ *If Yes, attach a separate sheet with a detailed explanation of the Code violation and the status of the resolution of the citation.*

10. What percentage of the work pertaining to this contract will you perform with your own employees?

\_\_\_\_\_ (Must be over 50%)

11. What type of work do you anticipate subcontracting? \_\_\_\_\_

\_\_\_\_\_

*Note: This symbol (➔) indicates required attachments.*

THE REMAINDER OF THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

Name of Bidder: \_\_\_\_\_

**PART 3 – BIDDER'S STATEMENT OF QUALIFICATIONS**

**NOONDAY CREEK WATER RECLAMATION FACILITY  
CHEMICAL SYSTEMS UPGRADE  
PROGRAM NO. T1023**

***FORM FOR SIMILAR SCOPE PROJECTS AND REFERENCES***

Facility/Project Name: \_\_\_\_\_

Address of Project: \_\_\_\_\_

Bid amount: \_\_\_\_\_ Final Contract amount: \_\_\_\_\_

Contract time: \_\_\_\_\_ days Completion time: \_\_\_\_\_ days

Year completed: \_\_\_\_\_

Description of work: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Explanation of any time extensions and/or changes in contract amount: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Owner Contact:

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

Telephone No.: \_\_\_\_\_

Architect/Engineer Contact:

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

Telephone No.: \_\_\_\_\_

*This form should be copied as necessary to provide one page per similarly scoped project (Item 2). Other descriptive information (in addition to this form) may also be attached if desired.*

Name of Bidder: \_\_\_\_\_

**PART 4 – AFFIDAVIT FOR CONTRACTOR**

I, the undersigned, \_\_\_\_\_ (typed name) as the authorized representative for \_\_\_\_\_ (typed company name), an interested contractor on Cobb County Water System projects, do hereby attest that all statements and representations made herein are true and correct to the best of my knowledge. These statements are made openly and freely without intent to influence or embellish actual conditions or circumstances that occurred.

I understand that the Cobb County Water System will investigate any and all statements and representations made by my firm and me and we freely give our permission for them to do so. I agree to waive any claims against the Cobb County Water System for the release of the information necessary to evaluate this submittal.

I am hereto sworn \_\_\_\_\_ (signature)  
\_\_\_\_\_  
\_\_\_\_\_ (title)  
\_\_\_\_\_  
\_\_\_\_\_ (firm name)

This date \_\_\_\_\_, \_\_\_\_\_

County of \_\_\_\_\_, State of \_\_\_\_\_

The foregoing instrument was acknowledged before me this \_\_\_\_\_ day of

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (Notary signature)  
\_\_\_\_\_  
\_\_\_\_\_ (typed Notary name)

My commission expires: \_\_\_\_\_

Name of Bidder: \_\_\_\_\_

**PART 5 – DISADVANTAGED BUSINESS ENTERPRISE (DBE)  
IDENTIFICATION FORM**

A Disadvantaged Business Enterprise (DBE) is generally defined as a Female, Black American, Hispanic American and any other minority owned business. See *Instructions to Bidders* (Section 00 21 13) and *Disadvantaged Business Enterprise (DBE) Participation* (Section 00 45 53) for additional information related to periodic reporting guidelines.

If your firm is classified as a Disadvantaged Business Enterprise (DBE), please complete this form and submit with bid response:

Cobb County Purchasing Department  
1772 County Services Parkway  
Marietta, GA 30008  
Fax: 770-528-1154  
Email: purchasing@cobbcounty.org

Name of Firm: \_\_\_\_\_

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

\_\_\_\_\_

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

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

DBE Certification Number: \_\_\_\_\_

Name of Certifying Organization: \_\_\_\_\_

**This information is acquired for documentation of participation only and will have no bearing on the award unless otherwise stated in the Advertisement for Bids.**

Bidder hereby agrees to commence work under this Contract promptly after receipt of Notice-to-Proceed and to complete the work within 270 calendar days. Should said work not be completed by that date, the sum of \$1,000.00 (One Thousand Dollars) per day will be paid by the Contractor to the Owner as liquidated damages for each consecutive calendar day of delay.

Receipt is acknowledged of the following addenda:

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

Bidder agrees that the Owner has the right to accept or reject any or all proposals and to waive all formalities.

Respectfully submitted,

\_\_\_\_\_  
Company

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

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

\_\_\_\_\_  
Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Address

CORPORATE SEAL

\_\_\_\_\_  
City/State/Zip Code

( ) \_\_\_\_\_  
Telephone

( ) \_\_\_\_\_  
Fax Number

\_\_\_\_\_  
Georgia Utility Contractor License No.

\*\* END OF SECTION \*\*

SECTION 00 43 13

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we \_\_\_\_\_, as Principal, hereinafter called the Bidder, and \_\_\_\_\_, a corporation duly organized under the laws of the State of \_\_\_\_\_, listed in the latest issue of U.S. Treasury Circular 570, and registered in the State of Georgia, as Surety, are held and firmly bound unto **COBB COUNTY**, a political subdivision of the State of Georgia, as Obligee, hereinafter called Owner, in the sum of \_\_\_\_\_ Dollars (in words), (\$ \_\_\_\_\_) (in figures), for the payment of which sum well and truly to be made, the said Bidder and the said Surety bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Bidder has submitted a bid for construction of this project located in Cobb County, Georgia, identified by the Cobb County Water System as **Program No. T1023** and known as **Noonday Creek Water Reclamation Facility Chemical Systems Upgrade**, consisting of **the replacement of existing ferrous chloride chemical system equipment, including storage tanks, pumps, chemical piping, electrical equipment, etc. with new storage tanks, peristaltic hose pumps, chemical piping, electrical equipment; the replacement of sodium hypochlorite chemical system equipment, including storage tanks, pumps, chemical piping, electrical equipment, etc. with new storage tanks, peristaltic hose pumps, chemical piping, electrical equipment; and the replacement of the existing sodium bisulfite chemical feed pumps with peristaltic hose pumps.**

NOW THEREFORE, if the Owner shall accept the bid of the Bidder and the Bidder shall enter into a contract with the Owner in accordance with the terms of such bid, and give such bond or bonds as may be specified in the Bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the execution thereof, or in the event of the failure of the Bidder to enter such Contract and give such bond or bonds, if the Bidder shall pay the Owner the penalty hereof, then this obligation shall be null and void, otherwise to remain in full force and effect, unless returned by Owner to Bidder; until Owner shall demand payment by Surety, all as allowed in Contract Documents.

*THE REMAINDER OF THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY*

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_ A.D. \_\_\_\_\_.

Attest:

\_\_\_\_\_

\_\_\_\_\_ (SEAL)

Principal (Bidder)

By:

\_\_\_\_\_

Signature

\_\_\_\_\_

Typed Name

\_\_\_\_\_

Title

Attest:

\_\_\_\_\_

\_\_\_\_\_ (SEAL)

Surety

By:

\_\_\_\_\_

Signature, Attorney-in-Fact

\_\_\_\_\_

Typed Name

(Attach Certified Copy of Power of Attorney)

**\*\* END OF SECTION \*\***

SECTION 00 45 19  
NON-COLLUSION AFFIDAVIT

STATE OF GEORGIA  
COUNTY OF COBB

PROGRAM NAME: Noonday Creek Water Reclamation Facility Chemical Systems Upgrade  
PROGRAM NO.: T1023

\_\_\_\_\_ Affiant  
(Name)

the \_\_\_\_\_  
(Title or relationship to Bidding Entity)

of \_\_\_\_\_  
(Bidder's Company Name)

Affiant states upon oath that he/she has not, by himself or herself or otherwise, prevented or attempted to prevent competition in the bidding on this project by any means whatever, either directly or indirectly.

Affiant further states that he/she has not, by himself or herself or for another, prevented or endeavored to prevent anyone from making a bid therefore by any means whatsoever, nor has caused or induced another to withdraw a bid for the work.

\_\_\_\_\_  
(Signature of Affiant)

Sworn to and subscribed  
before me, this \_\_\_\_\_  
day of \_\_\_\_\_, 20\_\_

\_\_\_\_\_  
Notary Public

\_\_\_\_\_  
County

My commission expires: \_\_\_\_\_

\*\* END OF SECTION \*\*

SECTION 00 45 49

GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT

1. GENERAL

- A. The Georgia Security and Immigration Compliance Act (O.C.G.A. § 13-10-91) requires every contractor of a public employer and every subcontractor of a public employer's contractor that enters into a contract for the physical performance of services must register and participate in a federal work authorization program to verify employment eligibility of all newly hired employees. The applicable federal work authorization program is currently "E-Verify", an internet-based system operated by the Department of Homeland Security in partnership with the Social Security Administration, pursuant to the Immigration Reform and Control Act of 1986 (IRCA).
- B. Compliance with the requirements of the Georgia Security and Immigration Compliance Act (O.C.G.A. § 13-10-91), Rule 300-10-1 of the Georgia Department of Labor, and the following Procedures and Requirements of Cobb County are conditions of this Contract for the physical performance of services.
- C. Definitions.

Affidavit – a written statement made or taken under oath before an officer of the court or a notary public or other person who duly has been authorized so to act.

Affiant – the person who makes and subscribes to a statement made under oath (affidavit).

Physical Performance of Services – any performance of labor or services for a public employer using a bidding process or by contract wherein the labor or services exceed \$2,499.99.

2. PROCEDURES AND REQUIREMENTS

- A. **The attached CONTRACTOR AFFIDAVIT & AGREEMENT (Exhibit A), signed and notarized by the Bidder, must be submitted with the Bid to attest the Bidder's compliance with the Act.**

**BIDS RECEIVED WITHOUT AN EXECUTED AFFIDAVIT WILL BE DEEMED NON-RESPONSIVE AND WILL BE DISQUALIFIED FROM FURTHER CONSIDERATION.**

- B. The Contractor (or any subcontractor, regardless of tier) shall notify the Owner within five (5) business days of entering into a contract or other agreement for hire with any subcontractor(s), regardless of tier.
- C. The Contractor shall obtain and provide to the Owner the attached Subcontractor Affidavit & Agreement (Exhibit A-1) and Immigration Compliance Certification (Exhibit A-2) from each subcontractor, regardless of tier, employed or retained for work under the Contract prior to the commencement of any work under the Contract or any subcontract.

- D. The Owner reserves the right to dismiss, or require the dismissal of, any contractor or subcontractor for failing to provide the required affidavit or certification and/or for failure to comply with the statutory requirements of O.C.G.A. § 13-10-91 and/or for providing false or misleading information upon the required affidavit(s) or certification(s).
- E. The Contractor and/or subcontractor retaining any other subcontractor to perform services under the Contract shall provide legal notice to any subcontractor of the requirements of the Owner for immigration compliance and further provide notice that the Owner reserves the right to dismiss, or require the dismissal of, any contractor or subcontractor for failing to provide the required affidavit or certification and/or for failure to comply with the statutory requirements of O.C.G.A. § 13-10-91 and/or for providing false or misleading information upon the required affidavit(s) or certification(s).
- F. Failure to comply with any of the Procedures and Requirements of the Owner (i.e., failure to timely supply required affidavits or compliance certification documents; failure to utilize federal work authorization procedures; failure to permit or facilitate audits or reviews of records by the Owner or State officials upon request; and/or failure to continue to meet any of the statutory or County obligations during the life of the contract) shall constitute a material breach of the Contract and shall entitle the Owner to dismiss the Contractor or to require the dismissal of any subcontractor or sub/subcontractor (irrespective of tier) for failing to fully comply with these requirements.
- G. Upon notice of a material breach of these provisions, the Contractor (or subcontractor, regardless of tier) is entitled to cure the breach within ten (10) days and provide evidence of such cure. Should the breach not be cured, the Owner shall be entitled to all available remedies, including termination of the contract, the requirement that a subcontractor be dismissed from performing work under the contract, and any and all damages permissible by law.
- H. Prior to commencing work under this Contract for the physical performance of services, the Contractor shall complete the attached Immigration Compliance Certification (Exhibit A-2) form and submit the same to the Owner.
- I. Prior to allowing any other subcontractor to perform work under the Contract, the Contractor shall obtain a completed Immigration Compliance Certification (Exhibit A-2) from each subcontractor (regardless of tier) and submit the same to the Owner.

*AFFIDAVITS AND FORMS ON FOLLOWING PAGES*

*THE REMAINDER OF THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY*

**CONTRACTOR AFFIDAVIT & AGREEMENT  
(EXHIBIT A)**

**This affidavit must be signed, notarized and submitted with any bid requiring the performance of physical services. If the affidavit is not submitted at the time of the bid, bid will be determined non-responsive and will be disqualified.**

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is contracting with Cobb County, Georgia, has registered with, is authorized to use, and is participating in a federal work authorization program (an electronic verification of work authorization program operated by the U.S. Department of Homeland Security or any equivalent federal work authorization program operated by the U.S. Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA)). The undersigned contractor further attests that it will continue to use the federal Employment Eligibility Verification (EEV) work authorization program throughout the contract period.

The undersigned further agrees that should it employ or contract with any subcontractor(s) or should its subcontractor(s) employ other subcontractor(s) for the physical performance of services pursuant to the contract with Cobb County, Georgia, the contractor or subcontractor will:

- (1) Notify the County within five business days of entering into a contract or agreement for hire with any subcontractor(s);
- (2) Secure from any subcontractor(s) and/or their subcontractor(s) verification of compliance with O.C.G.A. § 13-10-91 on the attached Subcontractor Affidavit & Agreement (EXHIBIT A-1) prior to the commencement of any work under the contract/agreement;
- (3) Secure from any subcontractor(s) and/or their subcontractor(s) a completed Immigration Compliance Certification (EXHIBIT A-2) prior to the commencement of any work under the contract/agreement;
- (4) Provide the subcontractor(s) with legal notice that Cobb County, Georgia, reserves the right to dismiss, or require the dismissal of, any contractor or subcontractor for failing to provide the affidavit and/or for failure to comply with the requirements referenced in the affidavit;
- (5) Maintain records of such compliance and provide a copy of each such verification to Cobb County, Georgia, at the time the subcontractor(s) is retained to perform such services or upon any request from Cobb County, Georgia; and
- (6) Maintain such records for a period of five (5) years.

\_\_\_\_\_  
EEV (E-Verify) Program User ID Number

\_\_\_\_\_  
EEV Program Date of Authorization

BY: \_\_\_\_\_  
Authorized Officer or Agent  
[Contractor Name]

\_\_\_\_\_  
Contractor Business Name

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

\_\_\_\_\_  
Date

SWORN AND SUBSCRIBED BEFORE ME  
ON THIS THE \_\_\_\_ DAY OF \_\_\_\_\_, 201\_\_

\_\_\_\_\_  
Notary Public  
Commission Expires: \_\_\_\_\_

*Effective 07/01/2013*

**SUBCONTRACTOR AFFIDAVIT & AGREEMENT  
(EXHIBIT A-1)**

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services on behalf of Cobb County, Georgia, has registered with, is authorized to use, and is participating in a federal work authorization program (an electronic verification of work authorization program operated by the U.S. Department of Homeland Security or any equivalent federal work authorization program operated by the U.S. Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA)). The undersigned subcontractor further attests that it will continue to use the federal Employment Eligibility Verification (EEV) work authorization program throughout the contract period.

The undersigned further agrees that should it employ or contract with any subcontractor(s) or should its subcontractor(s) employ other subcontractor(s) for the physical performance of services pursuant to the contract with Cobb County, Georgia, the undersigned subcontractor will:

- (1) Notify the County within five business days of entering into a contract or agreement for hire with any subcontractor(s);
- (2) Secure from any subcontractor(s) and/or their subcontractor(s) verification of compliance with O.C.G.A. § 13-10-91 on this Subcontractor Affidavit & Agreement (EXHIBIT A-1) form prior to the commencement of any work under the contract/agreement;
- (3) Secure from any subcontractor(s) and/or their subcontractor(s) a completed Immigration Compliance Certification (EXHIBIT A-2) prior to the commencement of any work under the contract/agreement;
- (4) Provide the subcontractor(s) with legal notice that Cobb County, Georgia, reserves the right to dismiss, or require the dismissal of, any contractor or subcontractor for failing to provide the affidavit and/or for failure to comply with the requirements referenced in the affidavit; and
- (5) Maintain records of such compliance and provide a copy of each such verification to Cobb County, Georgia, at the time the subcontractor(s) is retained to perform such services or upon any request from Cobb County, Georgia; and
- (6) Maintain such records for a period of five (5) years.

\_\_\_\_\_  
EEV (E-Verify) Program User ID Number

\_\_\_\_\_  
EEV Program Date of Authorization

BY: \_\_\_\_\_  
Authorized Officer or Agent  
[Subcontractor Name]

\_\_\_\_\_  
Subcontractor Business Name

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

\_\_\_\_\_  
Date

SWORN AND SUBSCRIBED BEFORE ME  
ON THIS THE \_\_\_\_ DAY OF \_\_\_\_\_, 201\_\_

\_\_\_\_\_  
Notary Public Commission  
Expires: \_\_\_\_\_

*Effective 07/01/2013*

**IMMIGRATION COMPLIANCE CERTIFICATION**  
**(To be completed by Contractors and all Subcontractors)**  
**(EXHIBIT A-2)**

I certify to the Cobb County Board of Commissioners that the following employees will be assigned to:

<i>(Project Name/Description)</i>		

I further certify to Cobb County, Georgia the following:

- The E-Verify program was used to verify the employment eligibility of each of the above-listed employees hired after the effective date of our contract to use the program;
- We have not received a Final Nonconfirmation response from E-Verify for any of the employees listed.
- If we receive a Final Nonconfirmation response from E-Verify for any of the employees listed above, we will immediately terminate that employee's involvement with the project.
- I have confirmed that we have an I-9 on file for every employee listed above and that to the best of my knowledge all the I-9s are accurate.
- To the best of my knowledge and belief, all of the employees on the above list are legally authorized to work in the United States.
- If any other employee is assigned to this Cobb County project, a certification will be provided for said employee prior to the employee commencing work on the project.

To the best of my knowledge and belief, the above certification is true, accurate and complete.

**Sworn to by:**

**Employer Name & Address:**

\_\_\_\_\_  
Signature of Officer

\_\_\_\_\_

\_\_\_\_\_  
Printed Name/Title

\_\_\_\_\_

\_\_\_\_\_  
Date

\_\_\_\_\_

SWORN AND SUBSCRIBED BEFORE ME  
ON THIS THE \_\_\_\_ DAY OF \_\_\_\_\_, 201\_\_

\_\_\_\_\_  
Notary Public  
Commission Expires: \_\_\_\_\_

*Effective 07/01/2013*

SECTION 00 45 53  
DISADVANTAGED BUSINESS ENTERPRISE (DBE) PARTICIPATION

As indicated in the *Instructions to Bidders* (Section 00 21 13), the Cobb County Government does not administer a Disadvantaged Business Enterprise (DBE) certification program; however, the County does desire to identify individuals/businesses certified and/or meeting the definition of a DBE who are providing products and/or services to Cobb County.

The Cobb County Government addresses DBE participation in the following ways:

1. All Contracts:
  - a. DBE firms are requested to identify such status at the time they register as a Vendor with the County. (Contact the Purchasing Department at 770-528-8400 or go to <http://purchasing.cobbcountyga.gov> for Vendor application instructions and forms.)
  - b. DBE firms are requested to identify themselves at the time they propose to do business with the County. Contractors are to indicate their status on the DBE Identification Form included in Section 00 41 13 of these Contract Documents and submit this form with their bid.
  - c. Contractors are requested to identify the DBE status and participation of any subcontractors that will be working on the project. This information is to be indicated on the Subcontractor Notification List (Section 00 73 18) submitted following award at the time of execution of the Contract Documents.
  - d. Contractors are requested to submit a *Cobb County Government Disadvantaged Business Participation Monthly Report* with each request for payment. A copy of this form and instructions for its use follow this page.
2. Specifically Identified Contracts:
  - a. Cobb County has established a Disadvantaged Business Enterprise Plan in accordance with the regulations of the U.S. Department of Transportation (U. S. Department of Transportation (USDOT), 49 CFR Part 26.) The Cobb County Department of Transportation is the lead agency for implementing the USDOT DBE Program for the County.
  - b. This Disadvantaged Business Enterprise Plan applies only to projects which are clearly identified at the time of advertisement for bids.

*THE REMAINDER OF THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY*

## DISADVANTAGED BUSINESS ENTERPRISE (DBE) PARTICIPATION REPORTING

All Cobb County Government contractors or vendors are requested to complete a report descriptive of any DBE subcontractor involvement in work for which the government is making payment. If otherwise specified in an RFP or contract, additional reporting forms may be required as well.

The objective of this request is to assist in the identification of Disadvantaged Business Enterprise (DBE) business participation with the Cobb County Government and to quantify that participation.

The Cobb County Government does not administer a DBE Certification Program. The principal certification agency for the State of Georgia is the Georgia Department of Transportation. As a Contractor/Vendor you are not responsible for verification of any DBE Certification information of your subcontractor(s).

### \*\*\* Instructions \*\*\*

1. Complete the following *DBE Participation Monthly Report* form and submit with each request for payment.
2. Upon receipt of a Contractor/Vendor payment request, County staff will record the information. In order to add or verify the prime contractor is registered as a DBE vendor in AMS, the County department/agency should send a copy of the DBE report to the Purchasing Department (Attn.: DBE Report).

### \*\*\* DBE Definition \*\*\*

A Disadvantaged Business Enterprise (DBE):

1. Is a firm that is under the control of someone in an ownership position (at least 51%) that:
  - a. Has membership in one or more of the following groups: Female, Black American, Hispanic American, Native American, Subcontinent Asian American and Asian-Pacific America. There may be other groups that may be eligible to be certified as DBE;
  - b. Is a U.S. citizen or lawfully admitted permanent resident of the U.S.; and,
  - c. Has a personal net worth which does not exceed \$750,000.
2. Meets the Small Business Administration's size standard for a small business and the average gross annual receipts for the three previous fiscal years does not exceed \$36.5 million; and,
3. Is organized as a for-profit business.

Note that the business may also be DBE eligible as a certified U.S. Small Business Administration 8(a) program participant.



SECTION 00 52 13  
AGREEMENT/CONTRACT

THIS AGREEMENT, made and entered into this \_\_\_ day of \_\_\_\_\_ in the year \_\_\_, by and between **COBB COUNTY**, a political subdivision of the State of Georgia, hereafter called the Owner, and \_\_\_\_\_, hereinafter called the Contractor.

WITNESSETH

That the Owner and the Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

**1. WORK**

The Contractor shall perform all work as specified or indicated in the Contract Documents for the completion of the project generally described as **Noonday Creek Water Reclamation Facility Chemical Systems Upgrade, Program No. T1023**.

The Owner shall not be liable to the Contractor for any neglect, default, delay or interference of or by any other contractor, nor shall any such neglect, default, delay or interference of any other contract or alteration which may be required in the work, release the Contractor from the obligation to finish the work within the time allowed.

**2. CONTRACT TIME AND LIQUIDATED DAMAGES**

The Contractor will commence the work required by the Contract Documents on the date specified in the Notice to Proceed and will complete the same within **Two Hundred Seventy (270)** calendar days, unless the period for completion is extended otherwise by the Contract Documents. Should said work not be completed by that date, the sum of **One Thousand Dollars (\$1,000)** per day will be paid by the Contractor to the Owner as liquidated damages for each consecutive calendar day of delay.

**3. CONTRACT PRICE**

The Contractor agrees to perform all the work described in the Contract Documents and comply with the terms therein for the sum of \_\_\_\_\_ Dollars (in words), (\$\_\_\_\_\_) (in figures), and/or as shown in the Bid Schedule.

**4. PAYMENTS**

It is hereby mutually agreed that the Owner is to pay and the Contractor is to receive the prices bid in the proposal herein contained, or hereto annexed, as full compensation for furnishing all materials, supplies, machinery, equipment, tools, apparatus and other means of construction, maintenance and repairs, and all management, supervision, and labor, and perform all construction maintenance and repair necessary to complete the work under the conditions herein specified and for fully complying with the terms and conditions of this Contract; provided that any increased cost to the Contractor due to any subsequent levy of Federal or State tax against any item entering into the work of this Contract exclusive of profits, may be reimbursed to the Contractor by the Owner as provided hereunder.

## 5. PROGRESS AND FINAL PAYMENTS

The Contractor shall submit an Application for payment in accordance with a schedule agreed upon in the preconstruction conference. The Contractor will provide, with the Payment Application, a line item breakdown of all previous costs to date plus the amount being applied for. The Owner will make payments to the Contractor within a reasonable period of time after receipt of the Payment Application; but may withhold payment if the Owner determines there is unsatisfactory job progress, defective work, disputed work, actual or potential third party claims, failure to make timely payments for labor or materials, damage to other entities connected with the project or reasonable evidence that the Contract cannot be completed for the balance of the Contract Price. Payments that are not unreasonably delayed will bear no interest penalties. The terms of this paragraph and the entire Contract Documents are intended to supersede all provisions of the Prompt Pay Act, O.C.G.A. 13-11-1 through 13-11-11.

The Contractor shall present to the Owner the final request for payment within forty-five (45) days of the final inspection of the work performed under this Contract. The Owner reserves the right to reject any and all payment claims made by the Contractor after the forty-five (45) day period. In connection herewith and by execution of this document, the Contractor hereby agrees to waive any and all rights to such payments, the claims for which have not been submitted to the Owner within the required forty-five (45) day period.

## 6. CONTRACT DOCUMENTS

The Contract Documents which comprise the Contract between Owner and Contractor are attached hereto and made a part hereof and consist of the following:

- A. ADVERTISEMENT FOR BIDS (00 11 13)
- B. INSTRUCTIONS TO BIDDERS (00 21 13)
- C. BID (00 41 13)
- D. CONTRACTOR'S QUALIFICATION STATEMENT (00 41 13)
- E. BID BOND (00 43 13)
- F. AGREEMENT/CONTRACT (00 52 13)
- G. NON-COLLUSION AFFIDAVIT (00 45 19)
- H. GEORGIA SECURITY AND IMMIGRATION ACT COMPLIANCE (00 45 49)
- I. DISADVANTAGED BUSINESS ENTERPRISE (DBE) PARTICIPATION (00 45 53)
- J. PERFORMANCE BOND (00 61 13.13)
- K. PAYMENT BOND (00 61 13.16)
- L. GENERAL CONDITIONS (00 72 00)
- M. INSURANCE REQUIREMENTS FOR CONTRACTORS (00 73 16)
- N. BUSINESS LICENSE (00 73 17)
- O. SUBCONTRACTOR NOTIFICATION LIST (00 73 18)
- P. SPECIFICATIONS: Divisions 01 through 46
- Q. DRAWINGS : Numbered \_\_\_\_\_, Dated \_\_\_\_\_
- R. ADDENDA: No \_\_\_\_\_ Dated \_\_\_\_\_

## 7. MISCELLANEOUS

- A. Terms used in this Agreement/Contract are defined in the General Conditions and shall have the meanings described therein.
- B. Neither Owner nor Contractor shall, without the prior written consent of the other, assign or sublet in whole or in part his interest under any of the Contract Documents; and specifically, Contractor shall not assign any monies due or to become due without the prior

written consent of the Owner.

- C. Owner and Contractor each binds himself, his partners, successors, assigns and legal representatives, to the other party hereto in respect to all covenants, agreements and obligations contained in the Contract Documents.
- D. Contract Documents constitute the entire Agreement/Contract between Owner and Contractor and may be altered, amended or repealed only by a duly executed written instrument, in the form of a change order.
- E. This Agreement shall be administered and interpreted under the laws of the State of Georgia. Jurisdiction of litigation arising from this Agreement shall be in that state and venue shall lie in Cobb County, Georgia. If any part of this Agreement is found to conflict with applicable laws, such part shall be inoperative, null, and void insofar as it conflicts with said laws, but the remainder of this Agreement shall be in full force and effect.

*THE REMAINDER OF THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY.*

IN WITNESS WHEREOF, the parties hereto have executed this Agreement/Contract the day and year first above written. The Cobb County Board of Commissioners authorized the Chairman to execute this Agreement/Contract, the same being recorded in Minutes of Meeting of Board of Commissioners.

IN WITNESS WHEREOF, this instrument is executed in four (4) counterparts, each one of which shall be deemed an original.

\_\_\_\_\_  
Date of BOC approval:

Recommended:

\_\_\_\_\_  
Stephen D. McCullers, P.E.  
Director  
Cobb County Water System

Approved as to form:

\_\_\_\_\_  
County Attorney

\_\_\_\_\_  
CONTRACTOR

**COBB COUNTY**  
\_\_\_\_\_  
OWNER

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

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

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Typed Name

Michael H. Boyce  
\_\_\_\_\_  
Typed Name

\_\_\_\_\_  
Title

Chairman, Cobb County  
\_\_\_\_\_  
Board of Commissioners

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

Attest:

Attest:

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

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

AFFIX SEAL

SECTION 00 61 13.13  
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we \_\_\_\_\_, as Principals, hereinafter called Contractor, and \_\_\_\_\_, a corporation duly organized under the laws of the State of \_\_\_\_\_, listed in the latest issue of U.S. Treasury Circular 570, and registered in the State of Georgia, as Surety, are held and firmly bound unto **COBB COUNTY**, hereinafter called Owner, in the sum of \_\_\_\_\_ Dollars (in words), (\$ \_\_\_\_\_) (in figures), for payment of which sum, well and truly to be made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Contractor has entered into a written contract dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, with the Owner for **Noonday Creek Water Reclamation Facility Chemical Systems Upgrade, Program No. T1023**, in accordance with drawings and specifications prepared by Engineering Strategies, Inc., which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void otherwise shall remain in full force and effect. The Surety hereby waives notice of any alteration or extension of time made by the Owner. Whenever Contractor shall be, and declared by Owner to be in default under the Contract, the owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

- A. Complete the Contract in accordance with its terms and conditions; or,
- B. Obtain a bid or bids for completing the Contract in accordance with its terms, and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Owner elects, upon determination by the Owner and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as Work progresses (even though there should be default or a succession of defaults) under the contract or contracts of completion arranged under this paragraph sufficient funds to pay the cost of completion less the balance of the contract prices; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the Contract Price", as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.

Any suit under this Bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due. No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of the Owner.

The Contractor is required to provide the Owner a one-year guarantee covering workmanship and materials of the Project. This Performance Bond shall remain in force for one year from the date of Acceptance of the Project by the Owner.

IN WITNESS WHEREOF, this instrument is executed in four (4) counterparts, each one of which shall be deemed an original, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

Attest:

\_\_\_\_\_

\_\_\_\_\_  
Principal (Bidder) (SEAL)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Typed Name

\_\_\_\_\_  
Title

Attest:

\_\_\_\_\_

\_\_\_\_\_  
Surety (SEAL)

\_\_\_\_\_  
Signature Attorney-in-Fact

\_\_\_\_\_  
Typed Name

(Attach Certified and Dated Copy of Power of Attorney)  
DO NOT DATE PERFORMANCE BOND. BOND DOCUMENT WILL BE DATED BY BOC.  
(Bond must not be dated prior to date of Agreement)

\*\* END OF SECTION \*\*

SECTION 00 61 13.16

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we \_\_\_\_\_, as Principals, hereinafter called Contractor, and \_\_\_\_\_, a corporation duly organized under the laws of the State of \_\_\_\_\_, listed in the latest issue of U.S. Treasury Circular 570, and registered in the State of Georgia, as Surety, are held and firmly bound unto **COBB COUNTY**, hereinafter called Owner, in the sum of \_\_\_\_\_ Dollars (in words), (\$ \_\_\_\_\_) (in figures), for payment of which sum, well and truly to be made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Contractor has entered into a written contract dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, with the Owner for **Noonday Creek Water Reclamation Facility Chemical Systems Upgrade, Program No. T1023**, in accordance with drawings and specifications prepared by Engineering Strategies, Inc., which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void otherwise shall remain in full force and effect. The Surety hereby waives notice of any alteration or extension of time made by the Owner. Whenever Contractor shall be, and declared by Owner to be in default under the Contract, the owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

- A. Complete the Contract in accordance with its terms and conditions; or,
- B. Obtain a bid or bids for completing the Contract in accordance with its terms, and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Owner elects, upon determination by the Owner and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as Work progresses (even though there should be default or a succession of defaults) under the contract or contracts of completion arranged under this paragraph sufficient funds to pay the cost of completion less the balance of the contract prices; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the Contract Price", as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.

Any suit under this Bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due. No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of the Owner.

The Contractor is required to provide the Owner a one-year guarantee covering workmanship and materials of the Project. This Performance Bond shall remain in force for one year from the date of Acceptance of the Project by the Owner.

IN WITNESS WHEREOF, this instrument is executed in four (4) counterparts, each one of which shall be deemed an original, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

Attest:

\_\_\_\_\_

\_\_\_\_\_  
Principal (Bidder) (SEAL)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Typed Name

\_\_\_\_\_  
Title

Attest:

\_\_\_\_\_

\_\_\_\_\_  
Surety (SEAL)

\_\_\_\_\_  
Signature Attorney-in-Fact

\_\_\_\_\_  
Typed Name

(Attach Certified and Dated Copy of Power of Attorney)  
DO NOT DATE PERFORMANCE BOND. BOND DOCUMENT WILL BE DATED BY BOC.  
(Bond must not be dated prior to date of Agreement)

\*\* END OF SECTION \*\*

SECTION 00 72 00  
GENERAL CONDITIONS

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## PART 1 GENERAL

### 1.01 DEFINITIONS OF WORDS AND TERMS

Where used in the Contract Documents, the following words and terms shall have the meanings indicated. The meanings shall be applicable to the singular, plural, masculine and feminine of the words and terms.

- A. Acceptance. Formal action of the Owner in determining that the Contractor's work has been completed in accordance with the Contract and in notifying the Contractor in writing of the acceptability of the work.
- B. Act of God. A cataclysmic phenomenon of nature, such as an earthquake, flood or cyclone. Rain, wind, high water, or other natural phenomenon that might reasonably have been anticipated from historical records of the general locality of the Work shall not be construed as acts of God.
- C. Addenda. Supplemental written specifications or drawings issued prior to execution of the Contract that modify or interpret the Contract Documents by addition, deletion, clarification, or corrections.
- D. Bid. Offer of a bidder submitted on the prescribed form setting forth the price or prices of the Work to be performed.
- E. Bidder. Individual, partnership, corporation, or a combination thereof, including joint venturers, offering a bid to perform the Work.
- F. Construction Manager. The person designated, in writing, by the Owner to act as its representative at the construction site and to perform construction inspection services and administrative functions relating to this Contract. Contact by the Contractor with the Owner and Engineer shall be through the Construction Manager.
- G. Contract. The writings and drawings embodying the legally binding obligations between the Owner and the Contractor for completion of the Work.
- H. Contract Documents. The Contract comprises the documents listed below. Approved shop drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
  - 1. Advertisement for Bids
  - 2. Instructions to Bidders
  - 3. Bid
  - 4. Bid Bond
  - 5. Agreement
  - 6. Noncollusion Affidavit
  - 7. Georgia Security and Immigration Compliance Affidavit
  - 8. Performance Bond
  - 9. Payment Bond
  - 10. Subcontractor Notification List
  - 11. General Conditions
  - 12. Specifications
  - 13. Contract Drawings
  - 14. Addenda
  - 15. Notice of Award

16. Notice to Proceed
  17. Change Orders
  18. Directives
- I. Contract Drawings. The drawings included in the Contract Documents plus those prepared by the Owner pursuant to the terms of the Contract. They include:
1. Drawings.
  2. Modifying drawings issued by addenda.
  3. Drawings submitted by the Owner to the Contractor during the progress of the Work either as attachments to the change orders or as explanatory supplements to drawings and modifying drawings issued by addenda.
- J. Contract Price. Amount payable to the Contractor under the terms and conditions of the Contract. Based on the price given on the bidding schedule, with adjustments made in accordance with the Contract.
- K. Contract Time. Number of calendar days stated in the Contract for the completion of the Work; such completion as evidenced by the Owner's Acceptance.
- L. Contractor. The individual, partnership, corporation, or combination thereof, including joint venturers who enter into the Contract with the Owner for the performance of the Work.
- M. Contractor's Plant and Equipment. Equipment, material, supplies, and all other items, except labor, brought onto the site by the Contractor to carry out the Work, but not to be incorporated in the Work.
- N. County. Cobb County, Cobb County Board of Commissioners, Cobb County Water System or any combination thereof. Also referred to as the Owner.
- O. Day. Calendar day.
- P. Direct. Action of the Owner or Construction Manager by which the Contractor is ordered to perform or refrain from performing work under the Contract.
- Q. Directive. Written documentation of the actions of the Owner or Construction Manager in directing the Contractor.
- R. Engineer. The entity designated by the Owner to address issues deferred to it that affects the design and intent of the design of the Project.
- S. Equipment. Mechanical, electrical, instrumentation or other device with one or more moving parts, or devices requiring an electrical, pneumatic, electronic, or hydraulic connection.
- T. Furnish. To deliver to the job site or other specified location any item, equipment or material.
- U. Herein. Refers to information presented in the Contract Documents.
- V. Holidays. Legal holidays are New Year's Day, Martin Luther King Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday

following Thanksgiving, and Christmas.

- W. Install. Placing, erecting, or constructing complete in place any item, equipment, or material.
- X. May. Refers to permissive actions.
- Y. Owner. Cobb County, a political subdivision of the State of Georgia and/or Cobb County Water System (may be used interchangeably).
- Z. Owner's Representative. The person designated in writing by the Owner to act as its agent on specified matters relating to this Contract.
- AA. Paragraph. For reference or citation purposes, paragraph shall refer to the paragraph, or paragraphs, called out by section number and alphanumeric designator. For example, this definition is found in paragraph 00 72 00-1.02; permits and licenses are discussed in paragraph 00 72 00-1.06 B.
- BB. Person. The term, person, includes firms, companies, corporations, partnerships, and joint ventures.
- CC. Project. The undertaking to be performed under the provisions of the Contract.
- DD. Provide. Furnish and install, complete in place.
- EE. Punch List. List of incomplete items of Work and of items of Work that are not in conformance with the Contract.
- FF. Resident Project Representative. See Construction Manager. The Construction Manager shall function as the Resident Project Representative (RPR).
- GG. Shall. Refers to actions by either the Contractor or the Owner and means the Contractor or Owner has entered into a covenant with the other party to do or perform the action.
- HH. Shown. Refers to information presented on the Drawings, with or without reference to the Drawings.
- II. Specifications. That part of the Contract Documents consisting of written descriptions of the technical features of materials, equipment, construction systems, standards, and workmanship.
- JJ. Specify. Refers to information described, shown, noted or presented in any manner in any part of the Contract.
- KK. Submittals. The information that is specified for submission to the Engineer through the Construction Manager in accordance with Division 1 of the Contract Documents.
- LL. Substantial Completion. Sufficient completion of the Project or the portion thereof to permit utilization of the Project, or portion thereof for its intended purpose. Substantial completion requires not only that the Work be sufficiently completed to permit utilization, but that the Owner can effectively utilize the substantially completed Work. Determination of substantial completion is solely at the discretion

of the Owner. Substantial completion does not mean complete in accordance with the Contract nor shall substantial completion of all or any part of the Project entitle the Contractor to acceptance under the Contract.

MM. Substantial Completion Date. Date when the Owner puts into service the Project, or that portion of the Project that has been determined to be substantially complete.

NN. Utility. All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, casings, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground or aboveground to furnish products or services related to, but not limited to, electricity, gases, steam, liquid petroleum products, telephone or other communications including fiber optics, cable television, sanitary sewer, storm sewer, water, and traffic control systems.

OO. Will. Refers to actions entered into by the Contractor or the Owner as a covenant with the other party to do or to perform the action.

PP. Work. The labor, materials, equipment, supplies, services, and other items necessary for the execution, completion and fulfillment of the Contract.

## 1.02 JOINT VENTURE CONTRACTOR

In the event the Contractor is a joint venture of two or more contractors, the grants, covenants, provisos and claims, rights, power, privileges and liabilities of the Contract shall be construed and held to be several as well as joint. Any notice, order, direct request or any communication required to be or that may be given by the Owner or the Construction Manager to the Contractor under this Contract, shall be well and sufficiently given to all persons being the Contractor if given to any one or more of such persons. Any notice, request or other communication given by any one of such persons to the Owner or the Construction Manager under this Contract shall be deemed to have been given by and shall bind all persons being the Contractor.

## 1.03 CONTRACT REQUIREMENTS

### A. SUCCESSORS' OBLIGATIONS:

The grants, covenants, provisos and claims, rights, powers, privileges and liabilities obtained in the Contract Documents shall be read and held as made by and with, and granted to and imposed upon, the Contractor and the Owner and their respective heirs, executors, administrators, successors and assigns.

### B. ASSIGNMENT OF CONTRACT:

The Contract shall not be assigned in whole or in part without the written consent of the Owner. Involuntary assignment of the Contract as caused by the Contractor being adjudged bankrupt, assignment of the Contract for the benefit of Contractor's creditors or appointment of a receiver on account of Contractor's insolvency shall be considered as failure to comply with the provisions of the Contract and subject to the termination provisions contained herein.

### C. WAIVER OF RIGHTS:

Except as herein provided, no action or want of action on the part of the Contractor,

Owner, Owner's Representative, Engineer or Construction Manager at any time with respect to the exercise of any right or remedies conferred upon them under this Contract shall be deemed to be a waiver on the part of the Contractor and Owner of any of their rights or remedies. No waiver shall be effective except in writing by the party to be charged. No waiver of one right or remedy shall act as a waiver of any other right or remedy or as a subsequent waiver of the same right or remedy.

D. AMENDMENT OF GENERAL CONDITIONS:

These general conditions may be amended only by mutual consent of the Owner and the Contractor in writing.

1.04 LABOR STANDARDS

No work shall be performed between the hours of 6:00 p.m. and 7:00 a.m. or on Saturdays, Sundays or holidays except as such work as is necessary for the proper care and protection of the Work already performed, in the case of an emergency, or during approved, scheduled, and planned connections to existing facilities.

It is understood that the proposed construction schedule is based upon a normal 40-hour, five-day workweek, less recognized holidays. The Contractor may schedule his operations as desired within the designated core work hours and may work up to 50 hours per week. If the Contractor desires to work in excess of this limit, the Contractor shall submit a written request through the Construction Manager to the Owner, a minimum of five days prior to the desired work date.

1.05 LAWS, REGULATIONS AND PERMITS

A. GENERAL:

The Contractor shall give the notices required by law and comply with all laws, ordinances, rules and regulations pertaining to the conduct of the Work. The Contractor shall be liable for violations of the law in connection with work provided by the Contractor. If the Contractor observes that the Drawings, Specifications or other portions of the Contract Documents are at variance with any laws, ordinances, rules or regulations, he shall promptly notify the Construction Manager in writing of such variance. The Owner shall promptly review the matter and, if necessary, shall issue a change order or take any other action necessary to bring about compliance with the law, ordinance, rule or regulation in question. Contractor agrees not to perform work known to be contrary to any laws, ordinances, rules or regulations.

B. PERMITS AND LICENSES:

Unless otherwise specified herein, permits and licenses from governmental agencies that are necessary only for and during the prosecution of the Work and the subsequent guarantee period, including the Cobb County Building Permits, shall be secured and paid for by the Contractor. Permits and licenses of regulatory agencies that are necessary to be maintained after completion of the guarantee period shall be secured and paid for by the Owner. Water and sewer impact fees are not applicable to this Project.

The Cobb County Land Disturbance Permit for this Project will be obtained by the Owner and will be made available to the Contractor. The Contractor shall be responsible for complying with all of the terms and special conditions of permit approvals.

## C. PATENTS AND ROYALTIES:

The costs involved in fees, royalties or claims for any patented invention, article, process or method that may be used upon or in a manner connected with the Work under this Contract or with the use of completed Work by the Owner, shall be paid by the Contractor. The Contractor and his sureties shall protect and hold the Owner, the Engineer, and the Construction Manager, together with their officers, agents and employees, harmless from any and all loss, defense cost, and expenses and against any and all demands made for such fees or claims brought or made by the holder of any invention or patent. Before final payment is made on the account of this Contract, the Contractor shall, if requested by the Owner, furnish acceptable proof of a proper release from all such fees or claims.

Should the Contractor, his agent, employee or any of them be enjoined from furnishing or using any invention, article, material or plans supplied or required to be supplied or used under this Contract, the Contractor shall promptly pay such royalties and secure the requisite licenses; or, subject to acceptance by the Owner, substitute other articles, materials or appliances in lieu thereof which are of equal efficiency, quality, finish, suitability and market value to those planned or required under the Contract. Descriptive information of these substitutions shall be submitted to the Engineer through the Construction Manager for determination of general conformance to the design concept and the construction Contract. Should the Owner elect to refuse the substitution, the Contractor agrees to pay such royalties and secure such valid licenses as may be requisite for the Owner, his officers, agents and employees or any of them, to use such invention, article, material or appliance without being disturbed or in any way interfered with by any proceeding in law or equity on account thereof.

### 1.06 HEADINGS

Headings to parts, divisions, sections, paragraphs, subparagraphs and forms are inserted for convenience of reference only and shall not affect the interpretation of the Contract Documents.

### 1.07 SUBCONTRACTS

The Contractor shall perform with his own organization not less than one-half of the Work and shall not sublet to one subcontractor more than one-third of the Work without the previous written consent of the Owner. The Contractor shall obtain the Owner's written consent of all subcontractors who will perform subcontract work.

## PART 2 OWNER-CONTRACTOR AUTHORITY/RESPONSIBILITY

### 2.01 AUTHORITY OF OWNER

#### A. GENERAL:

The Owner, acting through the Owner's Representative, the Engineer and the Construction Manager, shall have the authority to act as the sole judge of the work and materials with respect to both quantity and quality as set forth in the Contract. It is expressly stipulated that the Drawings, Specifications and other Contract Documents set forth the requirements as to the nature of the completed work and do not purport to control the method of performing work except in those instances where the nature of the completed work is dependent on the method of performance.

B. AUTHORITY OF OWNER'S REPRESENTATIVE:

1. General: The Owner's Representative has the authority to act on behalf of the Owner on change orders, directives, progress payments, contract decisions, acceptability of the Contractor's work, and early possession.
2. Change Orders: The Owner's Representative has the authority to make recommendations to the Board of Commissioners to accept or reject change orders proposed by the Construction Manager, the Engineer, or the Contractor.
3. Directives: The Owner's Representative has the authority to issue Directives to the Contractor and to accept or reject Directives that have been proposed by the Construction Manager.
4. Progress Payments: The Owner's Representative has the authority to accept or reject requests for progress payments that have been submitted by the Contractor and recommended by the Construction Manager.
5. Contract Decisions: Should the Contractor disagree with the Construction Manager's decision with respect to the Contract, the Contractor may request that the Owner's Representative review the Construction Manager's decision and make a determination on behalf of the Owner in the manner provided under paragraph 00 72 00-2.05 F.
6. Acceptability of Work: The Owner's Representative has the authority to make the final determination of the acceptability of the Work as provided under paragraph 00 72 00-6.05 and 00 72 00-6.07. The Owner's Representative also has the authority to accept or reject the Construction Manager's recommendations regarding retention of defective work as provided in paragraph 00 72 00-4.09 B.
7. Early Possession: The Owner's Representative has the authority to take early possession in accordance with paragraph 00 72 00-6.06.

C. AUTHORITY OF CONSTRUCTION MANAGER:

1. General: The Construction Manager is the construction site representative of the Owner employed to act as advisor and consultant to the Owner in construction matters related to the Contract. The Owner has delegated his authority to the Construction Manager to make initial decisions regarding questions which may arise as to the quality or acceptability of materials furnished and work performed and as to the manner of performance and rate of progress of the Work under the Contract. The Construction Manager interprets the intent and meaning of the Contract and makes initial decisions with respect to the Contractor's fulfillment of the Contract and the Contractor's entitlement to compensation. The Contractor shall look initially to the Construction Manager in matters relating to the Contract. The Construction Manager's decisions are subject to review by the Owner's Representative in accordance with paragraph 00 72 00-2.05 F.
2. Inspection of Construction: The Construction Manager shall have access to

the Work and to the site of the Work and to the places where work is being prepared or where materials, equipment, and machinery are being obtained for the Work. If requested by the Construction Manager, the Contractor shall provide the assistance necessary for obtaining such access, and shall provide information related to the inspection of construction.

3. Change Orders and Use of Allowances: The Construction Manager has the authority to initiate or recommend change orders or use of allowances. Such change orders and use of allowances are subject to review and approval by the Owner.
4. Limits of Construction Manager's Responsibility: The Construction Manager shall not be responsible for the acts or omissions of any contractor, or of any subcontractor, any supplier, or of any other person or organization performing or furnishing any of the Work. The Construction Manager shall not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents. Services provided by Construction Manager during construction shall not impose on Construction Manager responsibility to supervise, direct or control such work or for the means, methods, techniques, sequences or procedures of construction or safety precautions or programs incident thereto, or Contractor's compliance with laws, rules, regulations, ordinances, codes or orders applicable to Contractor's furnishing and performing the Work. Accordingly, Construction Manager neither guarantees the performance of any Contractor nor assumes responsibility for any Contractor's failure to furnish and perform its work in accordance with the Contract Documents.

#### D. AUTHORITY OF THE ENGINEER

1. General: The Engineer will assist the Owner by providing technical and engineering support services and coordinating with the Construction Manager during project coordination. The engineering support services will consist of technical reviews of requests for information submitted by the Contractor, development of Designer Clarifications, providing technical evaluations of Contractor-initiated and Owner-initiated change orders, review of Contractor-initiated substitution requests for equipment and/or materials, review of submittals, attendance at weekly progress meetings, periodic site visits, review of manufacturers' operations and maintenance manuals, development of an Operations Manual and assisting in plant start-up and operator training.
2. Limits of Engineer's Responsibility: The Engineer shall not be responsible for the acts or omissions of any contractor, or of any subcontractor, any supplier, or of any other person or organization performing or furnishing any of the Work. The Engineer shall not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents. Services provided by Engineer during construction shall not impose on Engineer responsibility to supervise, direct or control such work or for the means, methods, techniques, sequences or procedures of construction or safety precautions or programs incident thereto, or Contractor's compliance with laws, rules, regulations, ordinances, codes or orders applicable to Contractor's furnishing and performing the Work. Accordingly, Engineer neither guarantees the performance of any Contractor nor assumes responsibility for any Contractor's failure to furnish and perform its work in

accordance with the Contract Documents.

Engineer is not responsible for providing Resident Engineering services. Site visits/inspections are periodic. As such, the Engineer's professional opinions rendered pursuant to site visits/inspections shall be based solely upon the information provided, observations reported on, knowledge and belief, formulated in accordance with commonly accepted procedures consistent with applicable standards of practice, and as such does not constitute a guaranty or warranty, either expressed or implied.

## 2.02 RESPONSIBILITIES OF OWNER

### A. ATTENTION TO WORK:

The Owner shall notify the Contractor in writing of the name of the Owner's Representative and of the Construction Manager. The Construction Manager normally will be at the site of the Work. During his absences, the Contractor may contact a previously designated representative of the Construction Manager.

### B. OWNER'S EMPLOYEES:

The Owner shall be responsible for the adequacy, efficiency, and sufficiency of his employees and of any consultant, supplier or subcontractor employed by the Owner.

### C. REFERENCE POINTS:

The Owner or Engineer will provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable the Contractor to proceed with the Work.

## 2.03 AUTHORITY OF CONTRACTOR

### A. CONTRACTOR'S REPRESENTATIVE:

The Contractor shall notify the Owner in writing of the name of the person who will act as the Contractor's representative and shall have the authority to act in matters relating to this Contract. This person shall have authority to carry out the provisions of the Contract and to supply materials, equipment, tools and labor without delay for the performance of the Work.

### B. CONSTRUCTION PROCEDURES:

The Contractor will supervise and direct the Work. He has the authority to determine the means, methods, techniques, sequences and procedures of construction, except in those instances where the Owner, to define the quality of an item of work, specifies in the Contract, a means, method, technique, sequence or procedure for construction of that item of work.

### C. SUBCONTRACTORS:

Subcontractors will not be recognized as having a direct relationship with the Owner. The persons engaged in the Work, including employees of subcontractors and suppliers, will be considered employees of the Contractor and their work shall be subject to the provisions of the Contract. References in the Contract Documents to

actions required of subcontractors, manufacturers, suppliers, or any person other than the Contractor, the Owner, the Engineer or the Construction Manager shall be interpreted as requiring that the Contractor shall require such subcontractor, manufacturer, supplier or person to perform the specified action.

## 2.04 RESPONSIBILITIES OF CONTRACTOR

### A. SUBCONTRACTORS, MANUFACTURERS AND SUPPLIERS:

The Contractor shall be responsible for the adequacy, efficiency and sufficiency of subcontractors, manufacturers, suppliers and their employees.

The Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

The Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with the Construction Manager through the Contractor.

The divisions and sections of the Specifications and the identifications of any Drawings shall not control the Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

### B. CONTRACTOR'S EMPLOYEES:

The Contractor shall be responsible for the adequacy, efficiency and sufficiency of his employees. Workers shall have sufficient knowledge, skill and experience to perform properly the work assigned to them. Upon written notification from the Owner, Contractor shall immediately remove from the job, for its duration, any laborer, worker, mechanic, foreman, superintendent or other person employed who is found to be intemperate, troublesome, disorderly or otherwise objectionable. The Contractor shall enforce strict discipline and good order among its employees and subcontractors at all times during the performance of the Work.

### C. PAYMENT FOR LABOR AND MATERIALS:

The Contractor shall pay and require his subcontractors to pay any and all accounts for labor including Workers Compensation premiums, State Unemployment and Federal Social Security payments and other wage and salary deductions required by law. The Contractor also shall pay and cause his subcontractors to pay any and all accounts for services, equipment, and materials used by him and his subcontractors during the performance of Work under this Contract. Such accounts shall be paid as they become due and payable. If requested by the Owner, the Contractor shall furnish proof of payment of such accounts to the Owner.

The Contractor shall pay all sales, retail, occupational, service, excise, old age benefit and unemployment compensation taxes, consumer, use and other similar taxes, as well as any other taxes or duties on the materials, equipment, and labor for the work provided by the Contractor which are legally enacted by any municipal, county, state or federal authority, department or agency at the time bids are received, whether or not yet effective. The Contractor shall maintain records

pertaining to such taxes and levies as well as payment thereof and shall make the same available to the Owner at all reasonable times for inspection and copying.

The Contractor is obligated to comply with all local and State Sales and Use Tax laws. The Contractor shall provide the Owner with documentation to assist the Owner in obtaining sales and/or use tax refunds for eligible machinery and equipment used for the primary purpose of reducing or eliminating air or water pollution as provided for in Chapter 48-8-3 (36) and (37) of the Official Code of Georgia. All taxes shall be paid by the Contractor. All refunds will accrue to the Owner.

D. PROSECUTION OF THE WORK:

1. Attention to the Work: The Contractor, acting through his representative, shall give personal attention to and shall manage the Work so that it shall be prosecuted faithfully. When his representative is not personally present at the Project site, his designated alternate shall be available and shall have the authority to act on the Contract.
2. Protection of the Work: The Contractor shall take all necessary precautions and provide the necessary protection to prevent damage or loss to the Work, including work partially complete and stored materials and equipment to be incorporated into the Work, whether in storage on or off the site.
3. Extent of the Work: Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.
4. Lines and Grades. All Work shall be done to the lines, grades, and elevations indicated on the Drawings. Basic horizontal and vertical control points will be identified by Construction Manager to be used as datums for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as a part of the Work.

The Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, Contractor shall furnish, without charge, competent persons and such tools, stakes, and other materials as the Construction Manager may require in checking survey, layout, and measurement work performed by the Contractor.

The Contractor shall keep the Construction Manager informed, a reasonable time in advance, of the times and places at which it wishes to do Work, so that horizontal and vertical control points may be established, and any checking deemed necessary by the Construction Manager may be done with minimum inconvenience to the Construction Manager and minimum delay to the Contractor.

The Contractor shall remove and reconstruct work which is improperly located.

The Contractor shall protect all horizontal and vertical control points identified by the Construction Manager from damage. Contractor shall relocate all horizontal and vertical control points which will be impacted by the construction operations to a location on the Site which is acceptable to the Owner and the Construction Manager. Contractor shall replace all horizontal and vertical control points which are damaged.

5. Connections to Existing Facilities.

- a. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.
- b. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.
- c. At least 21 days prior to each connection to an existing facility, the Contractor shall submit to the Construction Manager for review and approval a detailed shutdown and connection plan in accordance with Section 01 33 23, Shop Drawings, Product Data, and Samples. A separate submittal is required for each connection to an existing facility. The shutdown and connection plan shall provide the Contractor's schedule for the shutdown and connection, sequencing details and sketches indicating the sequence of the Work to be performed, as well as a listing of the materials required for the Work. The Contractor's schedule for shutdowns and connections shall be acceptable to the Owner and the Construction Manager.
- d. Approximately 14 days prior to the scheduled shutdown, a coordination meeting shall be conducted to review the Contractor's shutdown and connection plan. The Contractor, Construction Manager, Engineer, and Owner shall attend the meeting. The Construction Manager shall preside at the meeting. The purpose of the meeting will be to review the schedule/sequence of activities for the shutdown and connection, establish coordination efforts, and develop contingency plans.
- e. A minimum of 7 days prior to the scheduled shutdown, based on discussions from the coordination meeting, the Contractor shall submit a revised shutdown and connection plan and a detailed responsibility matrix to the Construction Manager for review and approval. The Contractor shall also provide certification that all required materials for the connection

to the existing facility are onsite and ready for use.

- f. Within three days of receipt of an acceptable shutdown and connection plan and certification from the Contractor that all required materials to make the connection are onsite and ready for use, Owner shall grant permission to Contractor to make the connection; notwithstanding granting of permission, the Owner reserves the right to unilaterally cancel any planned shutdown if prevailing circumstances warrant such action.
- g. Prior to the commencement of each connection, the existing facility or pipeline to which the connection is being made and any other facilities connected thereto, shall be isolated from service and prepared for connection (e.g., evacuated, dewatered, etc.) by the Contractor at no additional cost to the Owner.
- h. Unless otherwise acceptable to the Owner and Construction Manager, each connection to an existing facility shall be scheduled independently of one another and shall not occur concurrently. The Contractor shall provide adequate equipment and workforce to ensure that the connection is completed within the required timeframe.
- i. The Contractor shall provide any additional temporary plugs, sleeves, couplings, closure pieces, restraining devices, bulkheads, dewatering pumps and systems, and any other miscellaneous appurtenances required to perform the Work in the specified sequence at no additional cost to the Owner.

#### E. USE OF THE SITE

- 1. Operating/Staging Area: Contractor shall confine all operations, including storage of materials on the site, to Owner-approved areas as shown on the Drawings.
- 2. Temporary Buildings: Temporary buildings (including storage sheds, shops, and offices) may be erected by the Contractor on the site only with the consent of the Owner and without expense to the Owner. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the Work. When the Contractor uses any portion of the site as a shop, the Contractor shall be responsible for any repairs, patching, or cleaning arising from such use and for obtaining any necessary permits to establish such shop or temporary storage facilities.
- 3. Use of Roadways: The Contractor shall use only established roadways or temporary roadways authorized by the Owner. When materials are transported during prosecution of the Work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by federal, state, or local law or regulation. Any damage to existing roadways caused by the Contractor's activities during prosecution of the Work shall be repaired by the Contractor.
- 4. Clean-up and Disposal/Removal of Materials: The Contractor shall clean up all refuse, rubbish, scrap materials, and debris caused by its operations to the

end that the site of the Work shall present a neat, orderly and workmanlike appearance at all times. The Contractor shall be responsible for compliance with all laws governing the storage and ultimate disposal of all such materials and components. The Contractor shall provide the Owner with a copy of all manifests and receipts evidencing proper disposal when required by the Owner or applicable law.

5. Employee Parking: On-site parking for the vehicles of the Contractor's or subcontractors' employees shall be restricted to those areas specifically designated for that purpose on the Drawings. If no such areas are shown, or if additional parking areas are required, it shall be the sole responsibility of the Contractor to arrange and pay for off-site employee parking and to provide transportation from the parking area to the Work site. Violations of on-site parking requirements will result in the impoundment and towing of vehicles, with all costs thereof to be paid by the owner of the vehicle(s). Repeated violations will result in the revocation of any on-site employee parking privileges.
6. Sanitary Facilities: The Contractor shall furnish temporary sanitary facilities at the site for the needs of all construction workers and others performing work or furnishing services on the Project. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site. The use of restroom facilities in any existing building on the site by employees of the Contractor or his subcontractors is prohibited.
7. Hazardous Materials, Fuel/Oil Storage: All hazardous materials shall be locked up in approved storage areas and containers, and in compliance with the latest EPA regulations. Fuel and oil storage areas on site shall be configured and maintained in strict conformance with federal, state, and local fire safety regulations and requirements.
8. Concrete Wastes. Waste concrete shall be deposited, and mix trucks washed out, in a properly designed and operated Concrete Waste Management area installed by the Contractor in a location approved by the Construction Manager and the Owner. Collected waste materials shall be disposed of by the Contractor in conformance with applicable laws and regulations, and in a manner acceptable to the Owner.
9. Temporary Residence. Travel trailers, recreational vehicles, mobile homes or similar means to provide overnight accommodations will not be allowed at the site of the Work. Workmen will not be allowed to remain on the site before or after work hours. Overnight use of the site will only be allowed when construction scheduling may require 24-hour shifts or when otherwise approved by the Owner.
10. Owner's Security Program. The Contractor and his employees, subcontractors, vendors, and other persons employed by the Contractor for the execution of the Work, shall comply with the Owner's security program related to the site of the Work and the operation of the facility. Security measures will involve proper identification of persons and vehicles, controlled

access to the facility during certain hours of the day and/or days of the week, maintenance of site fencing, and other related requirements. The Owner assumes no responsibility for the security of the Contractor's plant and equipment, nor for any materials or equipment stored by the Contractor on the site of the Work.

11. Dust Control. The Contractor shall be responsible for the control of fugitive dust emissions from the construction site, implementing measures such as appropriate planning, sequencing, and training, development of consistent materials handling procedures, application of dust suppressants, use of wind barriers, and other project-specific measures. The Contractor shall make adequate provision to fully protect the surrounding area from damage by dust, fumes, or spray caused by construction activities. Protect all of the Owner's existing facilities (indoors or out), including motors, bearings, electrical gear, instrumentation, HVAC equipment, and building surfaces by enclosure, masking, covering, exhausting, containment, dust palliatives, or other effective means. The disposable intake filters of existing HVAC units with the impact zone of construction activities shall be replaced by the Contractor on a monthly basis for the duration of the Project, or until adequate stabilization of surfaces is attained in the opinion of the Construction Manager.

F. PROTECTION OF WORK, PROPERTY, AND PERSONS:

1. The Contractor shall be responsible for conditions of the site, including safety of all persons and property, during performance of the Work. The Contractor shall maintain the site and perform the Work in a manner which meets all statutory and common law requirements or other specific contractual requirements for the provision of a safe place to work and which adequately protects the safety of all persons and property on or near the site. This obligation shall apply continuously and shall not be limited to normal working hours. The Owner's inspection of the Work or presence at the site does not and shall not be construed to include review of the adequacy of the Contractor's safety measures in, on or near the site of the Work.
2. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs, including adequate safety training, in connection with the Work. The Contractor shall comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority having jurisdiction bearing on the safety of persons or property or their protection from damage, injury, or loss.
3. Unless otherwise required in the Contract Documents, the Contractor shall protect and be responsible for any damage or loss to the Work or to the materials and equipment associated with the Work until the date of Substantial Completion. The Contractor remains responsible for any damage or loss caused directly or indirectly by the acts or omissions of the Contractor, subcontractors, suppliers, or third parties authorized or allowed on the site by the Contractor until Acceptance of the Project.
4. The Contractor shall also be solely and completely responsible for damages arising from the Work that affect property adjacent to the site.
5. The Contractor shall repair or replace without cost to the Owner any damage

or loss that may occur, except damages or loss caused by the acts or omissions of the Owner.

6. The Contractor shall erect and maintain adequate signs, fencing, barricades, lights, or security measures and persons to protect the Work until the Owner's Representative authorizes in writing the removal of signs, fencing, barricades, lights, or security measures.

G. PROTECTION OF PERSONS:

1. The Contractor shall take all reasonable precautions for the safety of all employees working on this Contract and all other persons who may be affected by such work. The Contractor shall designate a responsible member of its organization at the site whose duty shall be to manage and coordinate the safety programs and to prevent accidents of the Contractor and subcontractors.
2. Except as otherwise stated in the Contract, if the Contractor encounters, on the site, material reasonably believed to be Hazardous Material including but not limited to asbestos, lead, or polychlorinated biphenyl (PCB), the Contractor shall immediately stop work in the area affected and give Notice of the condition to the Owner. Work in the affected area shall not be resumed without written direction by the Owner.
3. The Contractor shall maintain in a reasonable number of conspicuous and accessible places at the site all materials necessary for giving first aid to the injured. The Contractor shall establish, publish and make known to all employees procedures for ensuring immediate removal to a hospital or a doctor's care, of persons who may have been injured on the site. The Contractor shall ensure that at least one of its employees on site has adequate training in first aid. Employees shall not be permitted to work on the site before the Contractor has:
  - a. Provided all materials necessary for giving first aid at the site; and,
  - b. Established and made known procedures for removal of injured persons to a hospital or doctor's care.
4. In order to protect the lives and health of persons performing work under this Contract, the Contractor shall comply with the Federal Occupational Safety and Health Act of 1970 (OSHA), including all revisions, amendments, and regulations issued thereunder, and the provisions of state and local safety and health regulations. There is no acceptable deviation from these safety requirements, regardless of practice in the construction industry. Any violation of OSHA or other safety requirements applicable to the Work may be considered a breach of this Contract.
5. The Contractor's attention is drawn to the fact that additional hazards are present at facilities that convey, pump, and treat wastewater. These hazards arise from the presence of pathogens in the wastewater and from the slime and scum layer that coat walking, working, and other surfaces. In dealing with these hazards, the Contractor shall take special precautions appropriate for the prevailing conditions to ensure worker safety.

6. Work in Confined Spaces:

- a. The provisions of OSHA Regulation Standards – 29 CFR Section 1910.146, "Permit-Required Confined Spaces", have been adopted by Owner and shall apply to Work under this Contract. The Owner has established a confined-space entry program for its own use, and will be responsible for enforcement of the program for Owner's personnel only.
- b. The Contractor is hereby notified that the existing manholes and other structures on the site, included under the confined-space definition of 29 CFR 1910.146, shall be considered as hazardous locations with hazardous atmospheric conditions. The structures may contain methane, hydrogen sulfide, carbon dioxide, and other gases which are dangerous to life or health. Contractor shall allow its personnel or subcontractors to enter these confined spaces only through compliance with an entry permit program as specified herein.
- c. The Contractor shall establish and maintain a confined-space entry program appropriate to the structures and conditions encountered. The program shall meet the requirements of 29 CFR 1910.146 and shall specifically address the provisions of Paragraph (d) therein. The Contractor shall enforce the requirements of Paragraphs (e) and (f), shall establish and conduct a training program in accordance with Paragraph (g), and shall comply with all other applicable requirements of the referenced regulation.
- d. Upon request, the Owner's confined-space entry program will be made available to the Contractor for review, but Owner's program shall not be considered as necessarily addressing all steps and measures to be taken into account. Contractor shall cooperate with Owner for coordination of activities whenever Contractor's personnel and Owner's personnel will both be working in or near the confined spaces at the same time.

7. Lockout/Tagout. The Contractor is advised that the Owner has established a "Lock-out / Tag-out" program for the facility. The Contractor shall establish and adhere to a "Lock-out / Tag-out" program for new facilities and shall be responsible for adhering to the provisions of the Owner's program for existing facilities.

8. Hazardous Areas. The Contractor is advised that certain hazardous chemicals may be stored, handled, and used at wastewater treatment facilities. The Owner will make copies of MSDS sheets and other information about the chemicals, their uses and hazards available to Contractor's personnel, upon request of the Contractor. The Contractor shall be fully responsible for the safety of his employees and any subcontractors and shall develop and adhere to a site-specific safety program which accounts for the hazards of the facility.

H. COOPERATION WITH CONSTRUCTION MANAGER:

The Contractor, when requested, shall assist the Construction Manager in obtaining access to work that is to be inspected. The Contractor shall provide the Construction

Manager with information requested in connection with the inspection of the Work.

## 2.05 OWNER-CONTRACTOR COORDINATION

### A. SERVICE OF NOTICE:

Notice, order, direction, request or other communication given by the Construction Manager or Owner to the Contractor shall be deemed to be well and sufficiently given to the Contractor if left at any office used by the Contractor or delivered to any of his officers, clerks or employees or posted at the site of the Work or mailed to any post office addressed to the Contractor at the address given in the Contract or mailed to the Contractor's last known place of business. If mailed by first-class mail, any form of communication shall be deemed to have been given to and received by the Contractor a day after the day of mailing.

### B. SUGGESTIONS TO CONTRACTOR:

Plan or method of work suggested by the Owner or the Construction Manager to the Contractor but not specified or required, if adopted or followed by the Contractor in whole or in part, shall be used at the risk and responsibility of the Contractor. The Owner and the Construction Manager assume no responsibility therefor and in no way will be held liable for any defects in the Work which may result from or be caused by use of such plan or method of work.

### C. COOPERATION:

The Contractor agrees to permit entry to the site of the Work by the Owner or other contractors performing work on behalf of the Owner. The Contractor shall afford to the Owner, other subcontractors and their employees, reasonable facilities and cooperation and shall arrange his work and dispose of his materials in such a manner as to not interfere with the activities of the Owner or of others upon the site of the Work. The Contractor shall promptly make good any injury or damage that may be sustained by other contractors or employees of the Owner at his hands. The Contractor shall join his work to that of others and perform his work in proper sequence in relation to that of others.

If requested by the Contractor, the Owner shall arrange meetings with other contractors performing work on behalf of the Owner to plan coordination of construction activities. The Owner shall keep the Contractor informed of the planned activities of other contractors.

Differences or conflicts arising between the Contractor and other contractors employed by the Owner or between the Contractor and the workers of the Owner with regard to their work shall be submitted to the Construction Manager for his decision in the matter. If the work of the Contractor is affected or delayed because of any act or omission of other contractors or of the Owner, the Contractor may submit for the Owner's consideration, a documented request for a change order.

### D. DEVIATION FROM CONTRACT:

The Contractor shall not make an alteration or variation in, addition to, or deviation or omission from the terms of this Contract without the written consent of the Owner.

E. APPEAL TO THE CONSTRUCTION MANAGER FOR RECONSIDERATION OR FOR COMPENSATION:

1. In the event the Contractor disagrees with a decision of the Construction Manager or considers that the decision requires extra Work which causes additional costs or cause additional time on the critical path, he shall, within 5 calendar days, notify the Construction Manager in writing of the disagreement or of the claimed extra Work involved and the associated estimated additional cost and additional time of said Work.
2. The Contractor shall prepare and submit complete documentation of the nature and cost of extra Work within 10 calendar days of submittal of written notification of disagreement.
3. The Construction Manager shall make a determination in writing to the Contractor within 10 calendar days from the receipt of the Contractor's complete submittal of the nature and cost of the alleged extra Work.

F. APPEALS TO THE OWNER'S REPRESENTATIVE:

1. In the event the Contractor disagrees with any determination or decision of the Construction Manager, the Contractor may appeal the determination or decision to the Owner's Representative.
2. A Notice of Appeal must be submitted in writing by the Contractor to the Owner's Representative within 15 calendar days of the date of such determination or decision by the Construction Manager. Failure of the Contractor to appeal the decision or determination of the Construction Manager within said 15-day period shall constitute a waiver of the Contractor's right to thereafter assert an appeal resulting from such determination or decision.
3. Within 30 calendar days following the submittal of a Notice of Appeal the Contractor must submit in writing full documentation related to the Appeal, including:
  - a. A detailed factual statement of the Appeal providing all necessary details, dates, locations, and items of Contract Work affected;
  - b. Copies of documents and a written description of the substance of any oral communications that concern or relate to the Appeal;
  - c. The specific provisions of the Contract Documents on which the Appeal is based;
  - d. If an adjustment in the Contract Price is sought, the exact amount sought, accompanied with all records meeting the requirements herein for Contractor Change Proposals; and,
  - e. If an adjustment in the Contract Time is sought, the specific days and dates for which it is sought, accompanied by a schedule analysis meeting the requirements herein for Changes in Contract Time.
4. The Owner's Representative shall review the appeal and transmit his decision

in writing to the Contractor within 45 calendar days from the date of receipt of the appeal. At the discretion of the Owner's Representative, additional information may be requested from the Contractor or the review period may be extended, following written notice to the Contractor.

5. Pending final decision of an Appeal hereunder, the Contractor shall proceed diligently with the performance of the Work, including that work associated with the Appeal, and maintain its progress with the Work.
6. The Contractor shall have the burden of proof to demonstrate entitlement to the relief sought through the Appeal process.

G. USE OF CONTRACTOR'S PLANT AND EQUIPMENT:

Contractor agrees to make available to the Owner his plant and equipment for the performance of work at the Project site. The Owner agrees that the use of such plant and equipment shall be considered as extra work and paid for accordingly.

PART 3 SPECIFICATIONS AND DRAWINGS

3.01 INTERPRETATION OF SPECIFICATIONS AND DRAWINGS

A. GENERAL:

The Specifications and Drawings are intended to be complementary of each other. Work specified on the Drawings and not in the Specifications, or vice versa, shall be executed as if specified in both.

B. BEFORE STARTING CONSTRUCTION:

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 through Construction Manager any conflict, error, ambiguity or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from the Construction Manager before proceeding with any work affected thereby; however, Contractor shall not be liable to Owner, Construction Manager 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.

C. REQUEST FOR CLARIFICATION:

In the event the Work to be done or matters relative thereto are not sufficiently detailed or explained in the Contract Documents, the Contractor shall apply to the Engineer through the Construction Manager for further explanations as may be necessary and shall conform thereto so far as may be consistent with the terms of the Contract. In the event of doubt or question arising respecting the true meaning of the Specifications or Drawings, reference shall be made to the Construction Manager for his decision. Should the Contractor disagree with the Construction Manager's decision, he may appeal to the Owner's Representative in accordance with paragraph 00 72 00-2.05 E.

### 3.02 DIVISION OF SPECIFICATIONS AND DRAWINGS

Specifications and Drawings are divided into groups for the convenience of the Owner, Construction Manager and Engineer. These divisions are not for the purpose of apportioning work or responsibility for work among subcontractors, suppliers and manufacturers.

### 3.03 DISCREPANCIES IN SPECIFICATIONS AND DRAWINGS; DIFFERING CONDITIONS

#### A. ERRORS AND OMISSIONS:

If the Contractor, in the course of the Work, becomes aware of any claimed errors or omissions in the Contract Documents or in the Owner's fieldwork, he shall immediately inform the Construction Manager in writing. The Construction Manager shall promptly review the matter and if he finds an error or omission has been made, he shall determine the corrective actions and advise the Contractor accordingly. If the corrective work associated with an error or omission increases or decreases the amount of work called for in the Contract, an adjustment to the Contract will be developed through the procedures outlined herein for Changes in the Work. After discovery of an error or omission by the Contractor, related work performed by the Contractor shall be done at his risk unless authorized by the Construction Manager. In the event the Contractor disagrees with the determination of the Construction Manager under this provision, he may appeal to the Owner's Representative in accordance with paragraph 00 72 00-2.05 F.

#### B. CONFLICTING PROVISIONS:

In cases of conflict between the Specifications and Drawings, the Specifications shall govern. Figure dimensions on drawings shall govern over scale dimensions and detail drawings shall govern over general drawings. In the event an item of work is described differently in two or more locations on the Drawings and in the Specifications, the Contractor shall request a clarification from the Engineer through the Construction Manager.

#### C. UNDERGROUND FACILITIES:

The Owner has endeavored to determine the existence of underground facilities at the site of the Work from the records of the owners of known utilities in the vicinity of the Work and from records of previous construction activities at the site. The positions of these underground facilities as derived from such records are shown on the Drawings. No excavations were made to verify the locations shown for underground facilities. The service connections to utilities are not shown on the Drawings. It shall be the responsibility of the Contractor to determine the exact location of underground facilities, utilities, and service connections thereto. The Contractor shall make his own investigations, including exploratory excavations, to determine the locations and type of existing underground facilities, prior to commencing work which could result in damage to such facilities. The Contractor shall immediately notify the Construction Manager as to any underground facility discovered by him in a different position than shown on the Drawings or which is not shown on the Drawings.

Work on underground facilities shall be performed and paid for as follows:

1. Shown or Indicated: the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
  - a. reviewing and checking all such information and data,
  - b. locating all underground facilities shown or indicated in the Contract Documents,
  - c. coordination of the Work with the owners of such underground facilities, including Owner, during construction, and
  - d. the safety and protection of all such underground facilities and repairing any damage thereto resulting from the Work.
  
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, or not shown or indicated with reasonable accuracy 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), identify the owner of such underground facility and give written notice to that owner and to Owner and Construction Manager. Construction Manager 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 or location of the underground facility. During such time, Contractor shall be responsible for the safety and protection of such underground facility.

If the Construction Manager concludes that a change in the Contract Documents is required, a Directive will be processed to reflect and document such consequences. An equitable adjustment may be made in the Contract Price or Contract Times, or both, to the extent that such adjustment is attributable to the existence or location of any underground facility that was not shown or indicated or not shown or indicated with reasonable accuracy 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. The adjustment to Contract Time shall be in conformance with the requirements specified elsewhere herein regarding impact to controlling activities on the critical path of the schedule.

E. DIFFERING SITE CONDITIONS:

1. The Contractor shall promptly, in any event no later than five days, and before such conditions are disturbed, notify the Owner in writing of:
  - a. Subsurface or latent physical conditions at the site differing materially from those indicated in this Contract.
  - b. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract.
  
2. Unless otherwise agreed upon in writing by the Construction Manager, within fourteen days of the Contractor's initial written notification of the Differing Site Condition to the Owner, the Contractor shall provide a change proposal in accordance with the requirements of paragraph 00 72 00-7.03 of this Section and:

- a. A detailed description of the Differing Site Condition; and,
  - b. Substantive, contractual, and technical basis supporting the existence of the Differing Site Condition and its impacts.
3. The Owner shall promptly investigate the alleged Differing Site Conditions and respond to the Contractor's Notice of Differing Site Conditions and issue a Directive if appropriate.
  4. Waiver:
    - a. If the Contractor's actions disturb the site such that the Owner or Construction Manager cannot adequately and fully investigate the alleged Differing Site Condition, the Contractor waives its right to receive any additional time or money as a result of the Differing Site Condition.
    - b. Failure by the Contractor to provide either (i) immediate notice or (ii) a change proposal shall constitute a waiver of the Contractor's right to receive any additional time or money as a result of the Differing Site Condition.
    - c. The Contractor shall be responsible for any and all costs or damages incurred by the Owner resulting from the Contractor's failure to provide appropriate notice and/or the detailed description and change proposal.
  5. The Contractor shall not disturb the condition until receipt of written authorization from the Construction Manager that work can resume at the location of the alleged Differing Site Condition. The Contractor shall continue with the performance of all other Work.

### 3.04 SUBMITTALS

Where required by the Specifications, the Contractor shall submit specified information which will enable the Engineer to determine and advise the Owner whether the Contractor's proposed materials, equipment or methods of work are in general conformance with the design concept and in compliance with the Drawings and Specifications.

### 3.05 CONTRACTOR'S COPIES OF CONTRACT DOCUMENTS

The Owner will furnish the Contractor four sets of Contract Documents, including full-size drawings, within 14 days after the issuance of the Notice-To-Proceed. The Contractor is advised that revisions incorporating changes by addenda may not be incorporated into the reduced or full-size drawings furnished under the provisions of this paragraph. Additional copies of the Contract Documents, if required by the Contractor, will be furnished by the Owner at cost. The Contractor shall keep at the construction site at least one set of the Contract Documents, including full-size drawings.

## PART 4 MATERIALS, EQUIPMENT AND WORKMANSHIP

### 4.01 GENERAL

Unless otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for materials, labor, tools, equipment, water, light, power, transportation, supervision, and temporary construction of any nature, and other services and facilities of any nature, whatsoever necessary, to execute, complete and deliver the Work within the specified time. Material and equipment shall be new and of a quality equal to that specified. Equipment offered shall be current modifications which have been in successful regular operation under comparable conditions. This requirement does not apply to minor details, nor to thoroughly demonstrated improvements in design or in materials of construction. Construction work shall be executed in conformity with the standard practice of the trade.

### 4.02 PRODUCT DATA

Data required by the Owner for inspecting, testing, operating or maintaining parts of the Work shall be provided by the Contractor when specified. Unless otherwise specified, such information shall consist of three copies and shall be provided at the time the referenced material or equipment is delivered to the job site. The data shall be as specified and include such items as shop drawings, erection drawings, reinforcing steel schedules, testing and adjusting instructions, operations manuals, maintenance procedures, parts lists and record drawings. When applicable, information and data to be provided shall be identified by the specified equipment number. Extraneous material on the pages or drawings provided shall be crossed out, and the equipment or material to be supplied shall be clearly marked. Such information is to be provided as part of the Work under this Contract and its acceptability determined under normal inspection procedures.

### 4.03 QUALITY

Where the Contract requires that materials or equipment be provided or that construction work be performed, and detailed specifications of such materials, equipment or construction work are not set forth, the Contractor shall perform the Work using materials and equipment of the best grade in quality and workmanship obtainable in the market, from firms of established good reputations, and shall follow standard practices in the performance of construction work. The work performed shall be in conformity and harmony with the intent to secure the standard of construction and equipment of work as a whole and in part.

### 4.04 MATERIAL AND EQUIPMENT SPECIFIED BY NAME

#### A. GENERAL:

When material or equipment is specified by reference to two or more patents, brand names, or catalog numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements, and that other materials or equipment, of equal capacities, quality and function shall be considered by the Owner upon the Contractor's request for substitution. Requests for substitution shall be made in accordance with paragraph 00 72 00-4.05.

## B. SINGLE SOURCE PRODUCTS:

If material or equipment is specified by only one patent or proprietary name, or by the name of only one manufacturer, it is for the purpose of standardization, or because the Owner knows of no equal. If standardization is the reason for using one name to specify any material or equipment, the specifications will so state that substitutions will not be considered. In other cases, the Contractor may offer substitutions of products considered to be equal to that specified. Such substitutions shall be requested in accordance with paragraph 00 72 00-4.05.

### 4.05 REQUESTS FOR SUBSTITUTION

The Contractor may offer material or equipment of equal or better quality and performance in substitution for those specified. The Owner will consider offers for substitution only from the Contractor and will not acknowledge or consider such offers from suppliers, distributors, manufacturers, or subcontractors. The Contractor's offers of substitution shall be made in writing to the Engineer through the Construction Manager and shall include sufficient data to enable the Engineer to assess the acceptability of the material or equipment for the particular application and requirements. All requests for substitution must be made within 120 days of the receipt of notice to proceed. Requests for substitutions submitted after this 120-day period will not be considered unless evidence is submitted to the Engineer through the Construction Manager that all of the following circumstances exist:

1. The specified product is unavailable for reasons beyond the control of the Contractor. Such reasons shall consist of strikes, bankruptcy, discontinuance of manufacturer, or acts of God.
2. The Contractor placed, or attempted to place, orders for the specified products within 30 days after Notice to Proceed.
3. Request for substitution is made in writing to the Engineer through the Construction Manager within 10 days of the date on which the Contractor ascertains that he cannot obtain the item specified.
4. Complete data as set forth herein to permit complete analysis of the proposed substitution is submitted with the request.

The Engineer's decision regarding evaluation of substitutions shall be considered final and binding. Requests for time extensions and additional costs based on submission of, acceptance of, or rejection of substitutions will not be allowed.

If the offered substitution necessitates changes to or coordination with other portions of the Work, the data submitted shall include drawings and details showing such changes. Contractor agrees to perform these changes as part of the substitution of material or equipment at no additional cost to the Owner. Within 30 calendar days after receipt of the offer of substitution, the Engineer will review the material submitted by the Contractor and advise the Contractor of objections, if any, to the proposed substitution or if further information is required. Upon notification by the Engineer, the Contractor shall either provide material or equipment that complies with Project Specifications or furnish requested additional information. While the Engineer might not take any objections to the proposed substitution, such action shall not relieve the Contractor from responsibility for the efficiency, sufficiency, quality and performance

of the substitute material or equipment, in the same manner and degree as the material and equipment specified by name. Any cost differential associated with a substitution shall be reflected in the offer and the Contract Documents shall be modified by Changes in the Work procedures.

#### 4.06 DEMONSTRATION OF COMPLIANCE WITH CONTRACT REQUIREMENTS

##### A. INSPECTION:

To demonstrate his compliance with the Contract requirements, the Contractor shall assist the Construction Manager in his performance of inspection work. The Contractor shall grant the Construction Manager access to the Work and to the site of the Work, and to the places where work is being prepared, or whence materials, equipment or machinery are being obtained for the Work. The Contractor shall provide information requested by the Construction Manager in connection with inspection work.

If the Contract Documents, laws, ordinances, or any public regulatory authority having jurisdiction requires parts of the Work to be specially inspected, tested or approved, the Contractor shall give the Construction Manager adequate prior written notice of the availability of the subject work for examination.

If parts of the Work are covered in contravention of the Construction Manager's directive, the cost of exposing the work for inspection and closing shall be borne by the Contractor regardless of whether or not the work is found to be in compliance with the Contract.

If any work is covered in the absence of the Construction Manager's directive to the contrary, the Contractor shall, if directed by the Construction Manager, uncover, expose or otherwise make available for inspection, portions of covered work. If it is found that such work is defective, the Contractor shall bear the expense of uncovering and reconstructing. If the work is found to be in compliance with the Contract, the Contractor will be allowed equitable compensation or an extension in the Contract Time, or both, except that extensions in Contract Time must meet the Contract requirements for impact on controlling activities. Recovery for such expense and/or time shall follow the procedures set forth herein for Changes in the Work.

##### B. SAMPLES OF MATERIALS:

In cases where compliance with Contract requirements for materials to be incorporated in the Work requires laboratory examination or special testing, the Contractor shall provide samples or specimens as requested by the Construction Manager. Such samples or specimens shall be provided in ample time to permit making proper test analysis and examinations before the time at which it is desired to incorporate the material into the Work. Tests of material will be conducted in accordance with the technical Specifications. In the absence of a specific test requirement, the Construction Manager will determine the appropriate standard test to be used. Unless stated otherwise in the Contract Documents, the costs of such examination or testing shall be borne by the Contractor.

#### C. CERTIFICATION:

In cases where compliance of materials or equipment to Contract requirements is not readily determinable through inspection and tests, the Construction Manager shall request that the Contractor provide properly authenticated documents, certificates or other satisfactory proof of compliance. These documents, certifications and proofs shall include performance characteristics, materials of construction and the physical or chemical characteristics of materials.

#### D. INSPECTION AT POINT OF MANUFACTURING:

If inspection and testing of materials or equipment in the vicinity of the Work by the Owner is not practicable, the Specifications may require that such inspection and testing or witnessing of tests take place at the point of manufacture. In this case and in the event the remote inspection and testing is not specified and is requested by the Owner, the required travel, subsistence, and labor expenses shall be paid by the Owner. If the Contractor requests the Owner to inspect and test material or equipment at the point of manufacture, then the additional cost to the Owner for travel, subsistence, and labor expenses shall be paid by the Contractor.

### 4.07 STORAGE OF MATERIALS AND EQUIPMENT

Materials and equipment shall be stored so as to ensure the preservation of their quality and fitness for the Work and so as to be protected from weather, damage, theft, and vandalism. Control panels, switchgear, drives, and other sensitive electrical and electronic equipment shall be stored indoors in a climate controlled environment. The Contractor shall be responsible for damages due to any cause that occur in connection with the care and protection of materials and equipment until Acceptance of the Work.

The Contractor is responsible for complying with the requirements of any manufacturer pertaining to the storage of their equipment, including but not limited to, motor rotation and lubrication, provision of temporary power for moisture control, provision of climate-controlled storage facilities, compliance with warranty restrictions on the use of the equipment for temporary construction-related purposes, and other special provisions as dictated by the manufacturer.

Stored equipment and materials shall be located so as to facilitate inspection. If space is available, materials and equipment may be stored on site in areas approved by the Owner; however, they shall be stored so as not to interfere with the Owner's operations or with other work, block passageways, or obstruct access/exits to buildings or facilities. Materials and equipment may be stored off site with the Owner's consent, if the Owner's interest in those materials and equipment is protected through insurance and the Contractor provides documentation of such insurance.

### 4.08 MANUFACTURER'S DIRECTIONS

Manufactured articles, material and equipment shall be applied, installed, connected, erected, adjusted, tested, operated and maintained as recommended by the manufacturer, unless otherwise specified. Manufacturer's installation instructions and procedures shall be provided prior to installation of the manufactured articles, material and equipment.

#### 4.09 DEFECTIVE WORK

##### A. CORRECTION OF DEFECTIVE WORK:

When, and as often as the Construction Manager determines through his inspection procedures, material, equipment or workmanship incorporated in the Project do not meet the requirements of the Contract, the Construction Manager shall give written notice of the noncompliance to the Contractor. Within five days from the receipt of such notice, the Contractor shall undertake the work necessary to correct the deficiencies, and to comply with the Contract. If the Contractor disagrees with the Construction Manager's determination and believes that the corrective work should be covered at the Owner's expense, he shall immediately notify the Owner's Representative, in writing, setting forth his position in accordance with the Appeals procedure in paragraph 00 72 00-2.05 F. If the Owner's Representative determines that the corrective work is required to comply with the Contract, the Contractor shall proceed with such work.

##### B. RETENTION OF DEFECTIVE WORK:

Prior to acceptance of the Project, the Owner may, at his option, retain work which is not in compliance with the Contract if the Owner determines that such defective work is not of sufficient magnitude or importance to make the work dangerous or undesirable. The Owner also may retain defective work, if, in the opinion of the Construction Manager, and with concurrence of the Owner's Representative, removal of such work is impractical or will create conditions that are dangerous or undesirable. Just and reasonable value for such defective work shall be judged by the Owner and appropriate deductions shall be made in the payments due, or to become due to the Contractor. Acceptance of the Project shall not act as a waiver of the Owner's right to recover from the Contractor an amount representing the deduction for retention of defective work.

#### 4.10 GUARANTEE

The guarantee period shall be for 365 days. Except for Work accepted as substantially complete, the guarantee period shall commence on the date of Acceptance of the Project. For Work described as substantially complete, the guarantee period shall commence on the date of substantial completion. During the guarantee period, the Contractor shall, upon the receipt of notice in writing from the Owner, promptly make all repairs arising out of defective materials, workmanship or equipment. The Owner is hereby authorized to make such repairs, if ten days after giving of such notice to the Contractor, the Contractor has failed to make or undertake the repairs with due diligence. In case of an emergency, where, in the opinion of the Owner, delay could cause serious loss or damage, repairs may be made without notice being sent to the Contractor and the expenses in connection therewith shall be charged to the Contractor.

For the purpose of this paragraph, "acceptance of the Work" shall mean the acceptance of the Project or a portion of the Project by the Owner, in accordance with paragraph 00 72 00-6.07. "Acceptance of the Work" shall not extinguish any covenant or agreement on the part of the Contractor to be performed or fulfilled under this Contract which has not, in fact, been performed or fulfilled at the time of such acceptance. All covenants and agreements shall continue to be binding on the Contractor until they have been fulfilled.

#### 4.11 MATERIALS AND EQUIPMENT FURNISHED BY OWNER

Materials and equipment specified to be furnished by the Owner shall be installed by the Contractor. Furnishing of material and equipment by the Owner will be considered conclusive evidence of their acceptability for the purpose intended. If the Contractor discovers defects in material or equipment furnished by the Owner, he shall notify the Construction Manager. After such discovery, the Contractor shall not proceed with work involving Owner-furnished materials and equipment unless authorized by the Construction Manager. Unless otherwise noted or specifically stated, materials and equipment furnished by the Owner, which are not of local occurrence, are considered to be FOB railroad station or truck terminal nearest to the site of the Work. After receipt by the Contractor at the point of destination, all risk of loss and damage to such materials and equipment shall be borne by the Contractor, as if it had been supplied and stored by the Contractor himself. The Contractor shall unload, transport, store and protect such material and equipment from damage.

### PART 5 LIABILITY AND INSURANCE

#### 5.01 LIABILITY OF CONTRACTOR

The Contractor shall be liable for any and all losses or damages from whatever cause which, prior to Acceptance of the Project, may occur on or to any part of the Work. The Contractor shall not be liable for losses or damages caused solely by the act of the Owner.

The Contractor shall be liable for damages and injury which shall be caused to persons owning property, on or in the vicinity of the Work, or which shall occur to a person, or persons, or property whatsoever, arising out of the Contractor's performance of this Contract. The Contractor's liability shall not be dependent upon whether or not such damage or injury is caused by the negligence of the Contractor, and whether or not such damage or injury be caused by the inherent nature of the Work as specified.

The Contractor shall indemnify and hold the Owner, the Construction Manager, the Engineer, and their officers, principals, agents, subcontractors, and employees, harmless from any and all loss, defense cost, expense, claims, demand or liability whatsoever, arising from allegations of injuries to persons or damage to property related to the performance of this Contract, regardless of concurrent negligence on the part of such indemnities. The indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under workers compensation acts, disability benefit acts, or other employee benefit act, nor shall it be limited to the limits of the liability insurance required by this Contract.

In case suit or legal proceeding shall be brought against the Owner, the Construction Manager, the Engineer, or their officers, principals, agents, subcontractors, or employees, on account of loss or damage sustained by person, or persons, or property, as a result of the performance of the Work covered by this Contract, the Contractor agrees to assume the defense thereof, and to pay the expenses connected therewith, and the judgments that may be obtained against the Owner, the Construction Manager, the Engineer, or their officers, principals, agents, subcontractors, or employees, in such suits. In the event that a lien is placed against the property of the Owner, the Construction Manager, the Engineer, or their officers, principals, agents, subcontractors, or employees, as a result of such suits, the Contractor agrees to at once cause the same

to be dissolved and discharged by giving bond or otherwise. The Contractor's agreement to defend and to pay the related expenses shall exist whether or not such injuries or damage be due to the negligence of the Contractor, and whether or not such injuries or damage be caused by the inherent nature of the Work, as specified.

The mention of specific duties or liabilities imposed on the Contractor shall not be construed as a limitation or restriction of general duties or liabilities imposed upon the Contractor by the Contract. Reference to specific duties or liabilities is made herein, merely for the purpose of explanation.

## 5.02 BONDS

The Contractor shall provide two bonds, each in the amount of 100 percent of the Contract Price. One shall serve as security for the faithful performance of the Work and the other as security for the faithful payment and satisfaction of the persons furnishing materials and performing labor on the Work. The bonds shall be issued by a corporation duly and legally licensed to transact surety business in the State of Georgia. Such bonds shall remain in force throughout the period required to complete the Work, and thereafter for a period of 365 calendar days after Acceptance of the Project. The bonds must be executed by a duly licensed surety company, which is listed in the latest Circular 570 of the United States Treasury Department, as being acceptable as surety on federal bonds. The Surety Company shall be licensed to do business in the State of Georgia. No surety's liability on the bonds shall exceed the underwriting limitations for the respective surety specified in Circular 570. The scope of the bonds or the forms thereof prescribed in these Contract Documents shall in no way affect or alter the liabilities of the Contractor to the Owner as set forth herein.

Companies providing Bonds under this Contract must have a current Best's rating not less than A and current Best's Financial Size Category less than Class IX. These requirements conform to the ratings published by A. M. Best & Company in the current Best's Key Rating Guide – Property-Casualty.

## 5.03 INSURANCE

The Contractor shall maintain throughout the Contract Period, all insurance coverage specified in Section 00 73 16. Evidences of insurance shall be provided to the Owner prior to execution of the Contract.

All policies shall contain provisions to the effect that in the event of payment of any loss or any damage, the insurers will have no right of recovery against the insured or additionally named insured thereunder.

## PART 6 PROGRESS AND COMPLETION

### 6.01 NOTICE TO PROCEED

After execution of the Contract by the Owner, written Notice to Proceed will be given by the Owner to Contractor. Notwithstanding other provisions of the Contract, the Contractor shall not be obligated to perform work, and the Owner shall not be obligated to accept or pay for work performed by the Contractor, prior to date of the Notice to proceed. The Owner's knowledge of work being performed prior to date of the Notice to Proceed shall not obligate the Owner to accept or pay for such work.

## 6.02 CONTRACT TIME

### A. GENERAL:

Time shall be of the essence of the Contract. The Contractor shall promptly start the Work after the date of the Notice to Proceed and shall prosecute the Work so that the Project as a whole and portions of the Project shall be complete within the times specified in Section 00 52 13. During periods when weather or other conditions are unfavorable for construction, the Contractor shall pursue only such portions of the Work as shall not be damaged thereby. No portions of the Work where acceptable quality or efficiency will be affected by unfavorable conditions shall be constructed while those conditions exist. It is expressly understood and agreed by and between the Contractor and the Owner that the Contract Time for completion of the Work described herein is a reasonable time taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work. The Contract Time may be changed only with a Change Order and in compliance with this Section and Section 00 72 00, Article 7.03 of these Specifications.

### B. CONSTRUCTION SCHEDULE:

The Contractor shall provide a construction schedule and reports as specified in Section 01 32 16 for scheduling and coordinating the Work within the Contract Time. Contract time extensions shall be incorporated into updated schedules, reflecting their effect at the time of occurrence. Failure of the Contractor to comply with these requirements for submittal of the construction schedule and reports may be cause for delay in review of progress payments by the Construction Manager.

### C. CONSTRUCTION PROGRESS:

The Contractor shall furnish such manpower, materials, facilities and equipment as may be necessary to insure the prosecution and completion of the Work in accordance with the accepted schedule. If work falls 14 days or more behind the accepted construction schedule, the Contractor agrees that he will take some or all of the following actions to return the Project to the accepted schedule. These actions may include the following:

1. Increase manpower in quantities and crafts.
2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of equipment, or any combination of the foregoing.
3. Reschedule activities.

If requested by the Construction Manager, the Contractor shall prepare a proposed schedule revision demonstrating a plan to make up the lag in progress and ensure completion of the Work within the Contract Time. The proposed revision shall be submitted to the Construction Manager in accordance with Section 01 32 16. Upon receipt of an acceptable proposed schedule revision, the revision to the construction schedule shall be made in accordance with Section 01 32 16. All actions to return the Project to the accepted schedule are at the Contractor's expense.

The Contractor shall pay all costs incurred by the Owner that result from the Contractor's action to return the Project to its accepted schedule. Contractor agrees that Owner shall deduct such charges from payments due the Contractor. It is further understood and agreed that none of the services performed by the Construction Manager in monitoring, reviewing and reporting Project status and progress shall relieve the Contractor of responsibility for planning and managing construction work in conformance with the construction schedule.

D. DELAYS:

1. Notice of Delays: When the Contractor foresees a delay in the prosecution of the Work and immediately upon the occurrence of a delay which the Contractor regards as unavoidable, he shall notify the Construction Manager in writing of the probability of the occurrence of such delay, the extent of the delay, and its possible cause. In any event, the Notice of Delay shall be submitted to the Construction Manager within seven days of the occurrence or of when the Contractor was aware of the likelihood of a possible delay. The Contractor shall take immediate steps to prevent, if possible, the occurrence or continuance of the delay. If this cannot be done, the Construction Manager shall determine how long the delay shall continue and to what extent the prosecution and completion of the Work are being delayed thereby. He shall also determine whether the delay is to be considered avoidable or unavoidable and shall notify the Contractor of his determination. The Contractor agrees that no claim shall be made for delays that are not called to the attention of the Construction Manager at the time of their occurrence. Within seven days of the submittal of the written Notice of Delay, the Contractor shall submit the following information:
  - a. Nature of the delay;
  - b. Date (or anticipated date) of commencement of delay;
  - c. Activities on the construction schedule affected by the delay, and/or new activities created by the delay and their relationship with existing activities;
  - d. Identification of person(s) or organization(s) or event(s) responsible for the delay;
  - e. Anticipated extent of the delay; and
  - f. Recommended action to avoid or minimize the delay.
2. Avoidable Delays: Avoidable delays in the prosecution of the Work shall include:
  - a. Delays that could have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or his subcontractors.
  - b. Delays which occur as a result of equipment maintenance, breakdown, or equipment that otherwise fails to operate properly.
  - c. Delays due to normal weather conditions.
  - d. Delays due to abnormal weather conditions for which the Contractor is specifically required to make provision.
  - e. Delays that may in themselves be unavoidable but which affect only a portion of the Work and do not necessarily prevent or delay the prosecution of other parts of the Work or the completion of the whole Work within the

## Contract Time.

- f. Delays associated with the reasonable interference of other contractors employed by the Owner that do not necessarily prevent the completion of the whole Work within the Contract Time.
3. Unavoidable Delays: Unavoidable delays in the prosecution or completion of the Work shall include delays which result from causes beyond the control of the Contractor and which could not have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or his subcontractors. Delays in completion of the work of other contractors employed by the Owner will be considered unavoidable delays insofar as they interfere with the Contractor's completion of the whole Work within the Contract Time. Delays caused by acts of God, fire, abnormal weather, floods, tidal waves, earthquakes, strikes, labor disputes, freight embargoes and shortages of materials shall be considered as unavoidable delays insofar as they prevent the Contractor from proceeding with at least seventy-five percent (75%) of the normal labor and equipment force for at least five hours per day toward completion of the current controlling item on the accepted critical path schedule.

## E. DAMAGES FOR DELAY:

For the period of time that any portion of the Work remains unfinished after the time fixed for completion in the Contract Documents, as modified by extensions of Contract Time granted by the Owner, it is understood and agreed by the Contractor and the Owner that the Contractor shall pay the Owner the amount of the liquidated damages specified in the Contract to cover the costs that the Owner suffers by failure of the Contractor to complete the Work within the stipulated time frame.

## F. EARLY COMPLETION

The Contractor may complete the Project or any part of the Project earlier than is stipulated in the Contract. The Contractor may schedule its work to complete earlier than required by the Contract or stipulated in the approved schedule; however, under no circumstances shall the Contractor be entitled to added compensation for delays that occur during the originally stipulated Contract period. The Owner has purchased the entire scheduled time period by virtue of this Contract and further stipulates that only those delays that meet the tests set forth within paragraph 00 72 00 - 7.03.G.4 will be considered for adjustment and only to the extent that they delay the Work past the originally contractually stipulated milestones or completion date.

## G. WEATHER DELAY

Contract Time will be extended as a result of weather delays based only on the following criteria.

General Requirements: Delays caused by abnormal weather shall be considered as unavoidable delays insofar as they prevent the Contractor from proceeding with at least seventy-five percent (75%) of the normal labor and equipment force for at least five hours per day toward completion of the current controlling item on the accepted critical path schedule. Even though a cause of delay meets any, or all, of the weather delay rules stated herein, it shall in all cases be presumed that no extension, or further extension, of time is due unless the Contractor shall

demonstrate that the delay is justified and had an impact to the critical path of the updated CPM schedule for the delay period. To this end, the Contractor shall maintain adequate records supporting any claim for an extension of time and shall submit such records, including a revised CPM schedule showing the impact of the delay, with the claim.

A Notice of Alleged Weather Delay shall be submitted in writing to the Construction Manager within seven days after the month for which the delay is claimed. Full supporting documentation, including a statement of the portions of the Work affected, an explanation as to the reasons work was prevented or hindered by the weather, the dates on which such portions of Work were affected, the total number of days believed that the job in its entirety was delayed, and the schedule update shall be submitted to the Construction Manager within seven days following submittal of the Notice. Failure by the Contractor to provide either (a) Notice of alleged weather delay or (b) full supporting documentation shall constitute a waiver of the Contractor's right to receive any additional time as a result of the alleged abnormal weather, unless the time for submitting the required information is extended in writing by the Construction Manager.

The Construction Manager will determine the Contractor's entitlement to an extension of the Contract Time, but in no event shall an extension be granted for days outside the Contract period. The daily records maintained by National Oceanic and Atmospheric Association's (NOAA) station located at the Atlanta Fulton County Airport (Charlie Brown Field), shall be the official source for weather data related to precipitation for this Project. A time extension of no more than one day will be granted for one day of lost work, regardless of the number of allowable reasons for lost time. The period of any extension of time shall be only for the portion of the Contract actually delayed due to the abnormal weather conditions. Any extension of Contract Time allowed under any of the following rules shall be considered non-compensable and have no impact on Contract Price.

1. Rule Number One: The total amount of precipitation that occurs during one calendar month.

If the actual amount of precipitation in a given month is less than the normal precipitation for that month, as stated in Figure 1, no claim will be allowed under this rule.

If the actual amount of precipitation for the month exceeds the normal amount, and the number of days having precipitation greater than one tenth (0.10") inch that is greater than the average number of precipitation days per month in Figure 2, then an application for extension is justified. One day time extension would be allowed for each day in excess of the average number of precipitation days. For each day, or period of consecutive days of "excess precipitation," a time extension of one day may be allowed for the following day as a "mud day." (See Rule Number Four.)

2. Rule Number Two: The frequency of the occurrences of precipitation during one calendar month.

Precipitation of greater than one-tenth (0.10") inch per day for three or more days of a consecutive five-day period is considered to be unusual frequency

and, as such, is considered to be justification for application for a one-day extension. This rule can be used even when Rule Number One is not applicable, but may not apply concurrently with other rules. For each "frequency of precipitation" day, a one day time extension may be allowed for the following day as a "mud day." (See Rule Number Four.)

3. Rule Number Three: Unusually heavy precipitation.

Precipitation of greater than one inch during a single day is considered to be justification for application for a one-day time extension. For each "heavy precipitation" day or period of consecutive days, a one-day time extension may be allowed for the following day as a "mud day." (See Rule Number Four.) Rule Number Three is applicable only after the precipitation for the month exceeds the normal precipitation for that month as stated in Figure 1.

4. Rule Number Four: The effect of precipitation on the Project's site conditions.

Unfavorable site conditions that hamper work can result from unusual weather during that period when the work is unenclosed. This rule considers both mud and snow cover according to the season. A one day time extension for "mud" may be allowed for each day, or period of consecutive days, approved under Rule Number One, Two and Three; however, only one application of this rule, mud or snow, per day is allowed. Three inches or more of snow cover is considered to be justification for application for an extension of time. Whether or not the Contractor took reasonable precautions to provide protection for the Work will be considered in the evaluation of impacts related to abnormal weather.

5. Rule Number Five: Temperature

A daily high temperature of twenty degrees Fahrenheit or less is considered to be justification for application for a one-day time extension. This rule cannot be applied concurrently with any other rule. Temperatures above the statistical mean are not considered to be justification for an extension of Contract Time.

Figure 1											
Normal Precipitation (all measurements are in inches)											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5.03	4.68	5.38	3.62	3.95	3.63	5.12	3.67	4.09	3.11	4.1	3.82

Figure 2											
Average Number of calendar days with Precipitation of 0.1 inches or more											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
12	10	11	9	9	10	12	9	8	7	8	10

[Information contained in Figures 1 and 2 are as provided by the U.S. National Oceanic and Atmosphere Administration (NOAA) Meteorological Data for Atlanta.]

## 6.03 SUSPENSION PROCEDURES

- A. The Owner may, at his convenience and at any time and without cause, suspend, delay, or interrupt all or any part of the Work for a period of not more than 90 days by notice in writing to the Contractor. The Owner shall fix the date on which the

Work shall be resumed. The Contractor shall resume the Work within 10 days after receiving written notice from the Owner to do so. The Contractor will be allowed an increase in the Contract Price or an extension of Contract Time, or both, directly attributable to any suspension if he makes a claim therefore as provided in the paragraphs related to change of Contract Price and change of Contract Time. Compensation for costs due to Suspension of the Work shall be limited to the direct costs of the Project as specified under Time and Expense Changes, except that no allowance will be made for overhead and profit. Additionally, the Contractor shall not be paid for extended home office overhead, lost use of capital, impairment of bonding capacity, loss of potential profit or any other direct costs.

- B. If the Contractor fails or refuses to perform its obligations in accordance with the Contract, the Owner may order the Contractor, in writing, to stop the Work, or any portion thereof, until satisfactory corrective action has been taken. The Contractor shall not be entitled to any adjustment in the Contract Time and/or Contract Price for any increased cost or time of performance attributable to the Contractor's failure or refusal to perform its obligations under the Contract.

#### 6.04 TERMINATION PROCEDURES

##### A. TERMINATION BY OWNER FOR DEFAULT:

The Owner may terminate the Contract upon seven days written notice to Contractor and his surety whenever the Contractor is deemed to be in default or fails to fulfill, in a timely and proper manner, the Contract obligations, or is in violation of any provisions or covenants of the Contract.

For purposes of this paragraph, the Contractor shall be deemed to be in default upon the occurrence of any one or more of the following events:

1. If Contractor is unable to demonstrate financial ability to finish the Project.
2. If Contractor makes a general assignment for the benefit of creditors.
3. If a trustee or receiver is appointed for Contractor, or for any of Contractor's property.
4. If Contractor files a petition to take advantage of any debtor's act, or to reorganize under any bankruptcy chapter or law.
5. If Contractor repeatedly fails to make prompt payments to subcontractors or others for labor, materials, or equipment.
6. If Contractor disregards laws, ordinances, rules, regulations, or orders of any public body having jurisdiction.
7. If Contractor disregards the authority of Construction Manager.
8. If Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure Substantial Completion of the Work within the Contract Time.
9. If Contractor fails to comply with Contract safety requirements.

10. If Contractor repeatedly fails to supply skilled workers or proper materials or equipment.
11. If Contractor violates in any substantial way the provisions of the Contract Documents by failing, neglecting, or refusing to proceed according to and in full compliance with the provisions and covenants of the Contract Documents.

If the Owner reasonably believes that one of the aforementioned events has occurred, the Owner will provide the Contractor with written Notice of its intent to terminate the Contractor for default, specifying within such notice the ground(s) for such termination. The Owner, at its option, shall require the Contractor to either promptly correct the deficiencies noted in the Owner's intent to terminate Notice or provide the Owner with a corrective action plan as to how such deficiencies will be remedied or cured in a timely fashion. If, after receipt of the proposed remedy, the Owner has a reasonable basis for concluding that the Contractor has (a) failed or is unwilling to repair, replace, or correct the deficiencies, or (b) failed or is unwilling to provide a reasonable and satisfactory corrective action plan, the Owner shall thereafter have the right to terminate this Contract for default.

After termination of Contractor for default, the Owner may exclude the Contractor from the site and take possession of the Work and all of the Contractor's tools, appliances, construction equipment, and machinery at the site and use the same to the full extent they could be used by the Contractor. The Owner may incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid the Contractor, but which are stored elsewhere.

If the Owner proceeds as with the Work, the Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds 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) sustained by the Owner arising out of or relating to completing the Work, such excess will be paid to the Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, the Contractor shall pay the difference to the Owner. Such claims, costs, losses, and damages incurred by the Owner will be reviewed by the Construction Manager as to their reasonableness and, when so approved by the Construction Manager, incorporated in a Change Order. When exercising any rights or remedies under this paragraph the Owner shall not be required to obtain the lowest price for the Work performed.

Where the Contractor's services have been so terminated by the Owner, the termination shall not affect any rights of the Owner against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies due the Contractor by the Owner will not release the Contractor from liability.

If the Owner terminates this agreement for default, and it is thereafter determined that the Contractor had not so failed to perform its obligations or defaulted in any way, the termination shall then be deemed to have been effected for the convenience of the Owner. In that event, any adjustment of compensation to Contractor shall be in accordance with paragraph 00 72 00-6.04 B.

B. TERMINATION BY OWNER FOR OTHER THAN DEFAULT:

The Owner may, without prejudice to any other remedy it may have under the provisions of the Contract, terminate this Contract, in whole or in part, at any time by giving written notice to Contractor or its representative by certified mail, return receipt requested. Termination shall be effective upon receipt of such notice by Contractor. Contractor shall immediately discontinue work and take all reasonable steps with its suppliers and subcontractors to minimize cancellation charges and other costs.

In the event of termination for reasons other than default of Contractor, Contractor shall be entitled to recover all reasonable costs incurred in connection with performance of the Work, plus any cost and expense reasonably and necessarily incurred in connection with such termination, plus a percentage of the profit based on the percentage of completion of the Work. The 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.

C. TERMINATION BY CONTRACTOR:

If the Work is stopped by order of a court, a public authority or the Owner for a period of 90 calendar days or more through no act or fault of the Contractor or anyone employed by him or his subcontractors, then the Contractor may terminate the Contract 10 calendar days after written notice to the Owner. Upon receipt of the written notice, the Owner shall implement procedures as set forth in paragraph 00 72 00-6.04 B.

6.05 SUBSTANTIAL COMPLETION

The Contractor, on considering the Work to be substantially complete and ready for its intended use, shall so notify the Construction Manager in writing. The notification shall include an itemized list of remaining incomplete work.

To be deemed substantially complete, the entire Project must be fully capable of providing its intended use, to the satisfaction of the Construction Manager, unless the Contract Documents expressly indicate that portions of the Project are required to be substantially complete prior to the completion of the entire Project. All portions of the Project shall be installed and operational, including accessories, controls, and safety devices. All functional testing, startup, checkout, and field performance testing (including specified equipment run-in times) shall be completed, and all manual and automatic controls shall be in place and operational as intended, including any remote reporting and control systems. All final coatings, paving, grading, and other finish items shall have been completed. Manufacturer's field test reports, O&M manuals, and warranties shall have been submitted and approved, and all required training shall have been successfully completed.

If the Construction Manager determines that the Work is not substantially complete, he will so notify the Contractor in writing identifying the reasons for such a determination. If the Construction Manager finds the Work substantially complete, he will meet with the Contractor to:

- A. Prepare a punch list;
- B. Define the division of responsibility between Owner and Contractor with respect to

security, operation, maintenance, heat, utilities, insurance, and warranties; and

- C. Describe any other issues related to acceptance of the substantially completed Work.

Upon reaching agreement with the Contractor, the Construction Manager will write to the Owner, certifying that the Work is substantially complete, identifying punch list items, stating the date for completion of incomplete Work, defining the division of responsibilities, and setting forth any other terms related to acceptance.

The Owner, who has sole discretion for determination of substantial completion, will review the Construction Manager's certification that the Work is substantially complete and concurring with that certification, will notify the Contractor, in writing, that the Work is accepted as substantially complete. Except for any portion(s) of work specified for early completion or required by the Owner for early possession (paragraph 00 72 00-6.06), substantial completion will not occur for any work until the entire Project is ready for possession and use. The acceptance notice will include a punch list of incomplete work items, set the date for their completion, describe the division of responsibility between the Owner and Contractor, and describe any other terms of acceptance. The Contractor will acknowledge receipt of the acceptance notice in writing, indicating acceptance of all of its terms and provisions.

Upon receipt of the Contractor's acknowledgment letter, the Owner shall take possession of the Work or portion of the Work and put it into its intended service. The date that the Work or portion of the Work is put into service will become the date of substantial completion. Unless otherwise specified, the Contractor's guarantee period and start date for associated warranties shall be the date that the portion of Work is put into service.

Subsequent to the substantial completion date, the Owner may exclude the Contractor from the Work during such periods when construction activities might interfere with the operation of the Project. The Owner, however, shall allow the Contractor reasonable access for completion or correction of incomplete punch list items.

Release of retainage will not be applied to substantial completion of components to be utilized by Owner prior to completion of the Project; retainage release will only be applied upon substantial completion of the entire Project. Upon attainment of Substantial Completion of the Project, the Contractor shall become eligible for payment of retainage, subject to a withholding of 200 percent of the value of the outstanding Work, including punch list items, as determined by the Construction Manager.

## 6.06 POSSESSION OF PORTIONS OF THE PROJECT

Should the Contractor fail to meet any date specified for substantial completion of the Work or any portion of the Work requiring early possession and use by the Owner, the Owner may, after written notice to the Contractor, take over such portion or all of the Work that is behind schedule. In such case, the Construction Manager will prepare a punch list. The Owner may allow the Contractor reasonable access to the Work at such times that the operation of the Project will not be affected or he may complete the Work himself after giving the Contractor notice of his intention to do so. The cost of Owner's work will be charged to and deducted from amounts due to the Contractor.

## 6.07 ACCEPTANCE OF THE PROJECT

Upon completion of the Work, including portions of the Work previously accepted as substantially complete, the Contractor shall so notify the Construction Manager in writing. Upon receipt of the notification, the Construction Manager will determine if the Work conforms to the terms of the Contract. If he finds materials, equipment, or workmanship that do not meet the terms of the Contract, he shall prepare a punch list of such items and submit it to the Contractor. Following completion of the corrective work by the Contractor, the Construction Manager shall notify the Owner that the Work has been completed in accordance with the Contract. Final determination of the acceptability shall be made by the Owner. Upon acceptance of the Project, the Owner shall immediately notify the Contractor and Construction Manager in writing. For portions of the Project not previously accepted as substantially complete, the conditions of guarantee shall commence on the date that the Owner issues a Notice of Completion.

The final application for payment shall be accompanied by all required documentation called for in the Contract including complete and legally effective releases or waivers of liens in a form acceptable to Owner. Subject to prior approval of Owner, Contractor may submit in lieu of the lien releases and waivers:

- A. Receipts of releases in full;
- B. An affidavit that the releases and receipts cover all labor, services, materials, and equipment for which a lien could be filed and that all payrolls, materials, 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; and
- C. Consent of the surety, if any, to final payment.

If any subcontractor or supplier fails to furnish a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any lien.

If, after reviewing the Contractor's final application for payment including all documentation required, the Construction Manager determines that the Work is complete, he will recommend that the Owner make final payment, including retainage. The final payment will be due and payable by the Owner within 45 days after any legal notice periods have expired.

## PART 7 MEASUREMENT AND PAYMENT

### 7.01 LIMITATIONS OF FUNDS

#### A. TERMS OF CONTRACT AND MONETARY OBLIGATION OF THE OWNER

1. Term: This Contract is for a term not to exceed one year and will terminate absolutely and without further obligation on the part of the Owner at the close (December 31) of the calendar year in which it was executed and at the close (midnight, December 31) of each succeeding calendar year in which it is renewed. This Contract will automatically renew at 12:01 AM, January 1 of the following calendar year unless the Owner notifies the Contractor in writing 10

days prior to the termination that the Contract will not be renewed.

2. Total Monetary Obligation: The total monetary obligation of the Owner under this Contract is shown above as the Contract Price. This Contract will terminate immediately and absolutely at such time as appropriated or unobligated funds are no longer available to satisfy the obligations of the Owner. This Contract does not create a debt of the Owner for payment of any sum beyond the calendar year of execution or, in the event of a renewal, beyond the calendar year of such renewal.
3. Annual Monetary Obligation: The amounts of the annual obligation indicated in the Contract/Agreement at the time of award and execution are percentages of the Contract Price, based on the Owner's perception at the time of award of the probable cash flow requirements for the Project. The Contract will be amended by a Supplemental Agreement at the beginning of each renewal year to adjust the amount of the monetary obligation, based on the Contractor's current schedule and cash flow projections. The cash flow projections will be determined by the Construction Manager from an evaluation of the Contractor's periodic schedule update, submitted in accordance with the requirements of Section 01 32 16 of these Contract Documents.

#### B. ADMINISTRATION OF FUNDS

1. Appropriations: The initial amount indicated in the Agreement/Contract has been appropriated for this Project and is available for payments to the Contractor during the first calendar year of the Contract. It is expected that the Owner will make appropriations for future renewal years and that the Contract will be amended as necessary.
2. Earnings in Excess Of Appropriations: If earnings will be such that funds appropriated for the Contract will be exhausted before the end of any calendar year, the Contractor shall give written notice to the Construction Manager of the estimated date of exhaustion and the amount of additional funds that will be needed to meet payments due to or to become due under the Contract during that calendar year. This notice shall be given no later than 60 days prior to the estimated date of exhaustion.
3. Suspension of Work: An equitable adjustment, in conformance with the Suspension Procedures clause of these Contract Documents, shall be made if suspension of the Work is made necessary by the exhaustion of funds. However, any suspension, delay or interruption of the Work arising as a result of an exhaustion of funds shall not constitute a breach of this Contract.
4. Excess Funds: If at any time it becomes apparent that the funds appropriated for any given calendar year are in excess of the funds required to meet all payments due or to become due the Contractor because of work performed or to be performed under the Contract during the calendar year, the Owner reserves the right to reduce said appropriation by the amount of such excess.

## 7.02 PAYMENTS TO CONTRACTOR

### A. BREAKDOWN OF CONTRACT PRICES:

Except in cases where unit prices form the basis for payment under the Contract, the Contractor shall, within 14 days of receipt of the Notice to Proceed, submit a breakdown of the Contract Price for the Construction Manager's review and approval showing the value assigned to each part of the Work including an allowance for profit and overhead. In submitting the breakdown, the Contractor certifies that it is not unbalanced and that the value assigned to each part of the Work represents his estimate of the actual cost, including profit and overhead, of performing that part of the Work. The breakdown shall be sufficiently detailed to permit its use by the Construction Manager as one of the bases for evaluating requests for payment.

### B. PROJECT STATUS REVIEW:

Contractor and Construction Manager shall meet each month prior to the Contractor submitting the progress payment request for the previous month. The purpose of the meeting is to review Project status in relation to the construction schedule; review values of Work completed during the previous month; and, if applicable, review Contractor's plans to return Project status to that required by the schedule. Within five days following this meeting, the Contractor shall submit a written progress report comprising:

1. A copy of the current construction schedule marked up to indicate percent complete, actual completion or start dates since the previous review, and the estimated remaining duration for each activity in progress.
2. Reasons any activities are behind schedule and of the corrective steps being taken.

### C. PROGRESS PAYMENTS:

1. Payment Request Procedures: Each month, the Contractor shall submit to the Construction Manager a partial payment estimate filled out and signed by the Contractor covering acceptable Work performed during the previous month, or since the last partial payment estimate was submitted. If requested by the Construction Manager, the Contractor shall provide such additional data as may be reasonably required to support the payment estimate. Such data may include satisfactory evidence of payment for equipment, materials and labor including payments to subcontractors and suppliers. Request for payment for delivered and stored equipment and material shall be accompanied by certified invoices by the suppliers and, in the case of equipment stored off site, documentation of insurance coverage. Such equipment and material shall be suitably and safely stored at the site of the Work or at an off-site location previously approved by the Owner. The Owner reserves the right to accept or reject pay requests for stored equipment or to limit payments to stored equipment which, in his opinion, is necessary for continuing satisfactory Project progress.

The monthly payment request shall be accompanied by a separate submittal consisting of the invoices received during the pay period for materials and equipment incorporated or to be incorporated into the Work. The invoices

should include the amount of Georgia sales tax paid. If sales tax is not included in the invoiced amount, the Contractor shall submit documentation evidencing the amount of sales tax paid to the State for the purchased materials and equipment. During the progress of the Work, each request for payment shall be accompanied by Contractor's updated Project schedule, progress photographs, required invoices, and other data specified herein or reasonably required by Engineer and/or Construction Manager.

2. Review Procedures: Within 10 days after receipt of the partial payment estimate, the Construction Manager will review the estimate and either indicate in writing to the Owner's Representative his concurrence with the estimate and his recommendation that payment be made, or indicate in writing to the Contractor his reasons for not concurring with the estimate. If the Construction Manager recommends payment and the Owner's Representative concurs, the Owner will, after receipt of the Construction Manager's recommendation, pay the Contractor a progress payment on the basis of the approved partial payment estimate. The payments will take into account the retention provisions provided for herein.

In the event the Construction Manager does not concur with the estimate, the Contractor may make the changes necessary to obtain the Construction Manager's concurrence and resubmit the partial payment estimate, or submit the original progress payment estimate directly to the Owner's Representative, indicating in writing his reasons for refusing to make the changes necessary to obtain concurrence.

3. Retention: The Owner shall retain a percentage of each payment except as specified below. The retained amount is available for the protection and payment of the person, or persons, mechanics, subcontractors, or materialmen who shall perform labor upon the Contract or work thereunder, and persons who shall supply such person, or persons, or subcontractors with components and supplies for carrying on such work.

The Owner shall retain 10 percent of each progress payment except and at the sole discretion of the Owner:

- a. Until the value of the Work completed is at least fifty percent (50%) of the Contract amount, the Owner shall retain ten percent (10%) of the value of all Work satisfactorily completed.
- b. After construction is fifty percent (50%) complete, the total amount retained to date will be held by the Owner, and all further Applications for Payment will be paid in full subject to the requirement that the total retention shall not be less than five percent (5%) of the Contract Amount, provided that, in the opinion of the Construction Manager, the Contractor is making satisfactory progress and there is no specific cause for greater withholding. Monies in retainage shall not become due the Contractor until after Substantial Completion is attained. The Construction Manager shall make his recommendation to the Owner's Representative for final approval of reduction of retainage. If there are any remaining incomplete minor items at the time Substantial Completion is attained, an amount equal to 200 percent of the value of each item, as determined by the Construction Manager, shall be withheld until such item or items are completed.

In no case will retainage be less than required by applicable laws and regulations. At any time during the Project the Contractor fails to maintain the progress of the Work on or ahead of schedule, the Owner may resume retainage of 10 percent of the amount of total progress payments to date until the Contractor is on or ahead of schedule or until final completion.

Retainage will be invested by the Owner and any interest earned will be paid to the Contractor when the Project has been completed within the time limits and for the price specified in the Contract or any approved amendments or change orders.

4. Withholding: The Construction Manager may refuse to recommend the whole or any part of any payment if in the Construction Manager's opinion it would be incorrect to make such recommendation to the Owner. The Construction Manager may also refuse to recommend any such payment, or because of subsequently discovered evidence or the result of tests, may nullify any such payment previously recommended to such extent as may be necessary in the Construction Manager's opinion to protect the Owner from loss as a result of:
  - a. Defective or damaged work.
  - b. A deductive change order.
  - c. Persistent failure of the Contractor to perform the Work in accordance with the Contract Documents, including failure to maintain the progress of the Work in accordance with the construction schedule. Persistent failure to maintain the progress of the Work shall mean that for a period of two consecutive months following a written notice from the Construction Manager, the Contractor fails to correct a behind-schedule condition at a rate that would reasonably indicate that he will finish the Project on schedule.
  - d. Disregard of authority of the Construction Manager or the laws of any public body having jurisdiction.

The Owner may refuse to make payment of the full amount recommended by the Construction Manager because of claims made against the Owner on account of Contractor's performance or furnishing the Work or because liens have been filed in connection with the Work or there are other items entitling Owner to reduce the amount recommended. In such case, the Owner shall give Contractor prompt written notice with copy to the Construction Manager stating the reasons for each action.

#### D. SALES TAX REPORT

1. General: The Official Code of Georgia, O.C.G 48-8-3, allows for the Owner to apply for a refund of sales taxes paid to the State of Georgia for the purchase of equipment and machinery associated with the reduction of air and water pollution. The Contractor shall submit information to the Owner pertaining to the cost of equipment and materials to facilitate the documentation requirements of this refund process.

2. Initial Determination of Eligibility: After Notice to Proceed and with submittal of the Schedule of Values, provide a report summarizing all materials and equipment to be purchased for incorporation into the project, sorted by specification section, function, costs, etc. This Summary Report is to be developed as a MS Excel spreadsheet consisting of the following columns: (a) Equipment/Material Name; (b) Specification Section; (c) Manufacturer; (d) Equipment/Material Description or Function; (e) Estimated Cost. A sample report will be provided by the Owner to illustrate the required format.

The completed Summary Report, accompanied by the Georgia State Department of Revenue Form ST-M7, "Application for Certificate of Exemption, Machinery for Reducing or Eliminating Air or Water Pollution" will be submitted by the Owner to the State for review. A "Certificate of Exemption" issued by the State will list which equipment and materials are approved as eligible for tax refund.

3. Periodic Documentation of Taxes Paid: A Sales Tax Report shall be completed and submitted with each pay application and shall be periodically expanded as the eligible equipment and materials are being purchased and invoiced. Monthly reports shall be accompanied by copies of the invoices for the equipment and materials identified in the report.

The Sales Tax Report is to be developed as an MS Excel spreadsheet consisting of the following columns: (a) Equipment/Material Name; (b) Vendor Name; (c) Vendor's Invoice No.; (d) Date of Invoice; (e) Total Amount of Invoice; (f) Sales Tax Paid; (g) Sales Tax Paid By. A sample report will be provided by the Owner to illustrate the required format.

4. Final Certification and Submittal: After the purchase of all eligible equipment and materials, a Final Sales Tax Report shall be prepared by the Contractor to accompany the Owner's submittal of the Georgia State Department of Revenue Form ST-12, "Sales Tax Claim and Refund." The Contractor shall obtain the following properly signed and executed forms from each vendor supplying eligible equipment and materials:
  - a. Georgia State Department of Revenue Form ST-12A, "Waiver of Vendor's Right for Refund."
  - b. Georgia State Department of Revenue Form ST-3, "Sales and Use Tax Form," showing evidence that the sales tax was paid.

The Owner will submit all forms to the Georgia Department of Revenue. The Final Sales Tax Report shall be provided by the Contractor in printed and electronic format. Electronic format shall be maintained in its native format, so that minor editing and formatting can be performed by the Owner if necessary.

#### E. FINAL PAYMENT:

The Owner will make final payment to the Contractor in the manner provided by law following the expiration of 45 calendar days after acceptance of the Work and issuance of the Notice of Completion by the Owner providing no liens or claims are outstanding. Final payment shall include the entire sum found to be due hereunder

after deducting from previous payments and such other lawful amounts as the terms of this Contract describe. Prior estimates and payments, including those relating to extra work or work omitted, shall be subject to correction by the final payment.

Acceptance by the Contractor of final payments shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor other than claims in stated amounts that may be specifically excepted by the Contractor for things done or furnished in connection with this Work and for every act and neglect of the Owner and others relating to or arising out of this Work. Payment by the Owner shall not release the Contractor or his surety from any obligation under the Contract or under the Performance Bond and Payment Bond.

## 7.03 CHANGES IN THE WORK

### A. GENERAL:

The Owner may, at any time, without notice to any surety, order additions, deletions or revisions in the Work. At the Owner's discretion, these changes may be compensated for from allowance monies included in the Contract Price, from credits for omitted Work, or from an increase in the Contract Price by a Change Order approved by the Board of Commissioners. Upon receipt of a Directive issued by the Owner's representative or the Construction Manager, the Contractor shall promptly proceed with the Work.

1. Owner-Initiated Changes: When the Owner desires a change in the Work, the Construction Manager will issue a Request for Proposal to the Contractor. The Contractor shall respond within the time indicated by the Construction Manager, or 15 days, whichever is less. If the Contractor fails to meet the submittal time required by this provision, the CONTRACTOR will be solely liable for any delays or impacts caused by the delayed submittal of the proposal.

If the Owner and the Contractor agree on the value of any work and the modification to the Contract Time that should be allowed as a result of the Contractor's response to a Request for Proposal, the Contractor shall proceed with the change upon receipt of a written notice from the Construction Manager. The final approval of any extension of Contract Time must be made by action of the Board of Commissioners.

2. Contractor-Initiated Changes: Any request by the Contractor for a change in the Contract Price or Contract Time shall be based upon a written notice of intent delivered by the Contractor to the Construction Manager promptly, but in no event later than 7 days after the start of the occurrence giving rise to the request for adjustment.

A notice of the amount of the request for adjustment in cost and/or time with supporting data shall be delivered within 14 days after the start of the occurrence, unless the Construction Manager allows an additional period of time to ascertain more accurate data in support of the request.

No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

3. Contractor Change Proposal Requirements: The Contractor's change proposal submitted for any potential change to the Contract shall be in a form acceptable to the Construction Manager. The Contractor's itemized estimate shall detail all applicable elements of cost, including, but not limited to, labor man-hours and payroll costs, quantities, crew mixes, production rates, material costs, subcontractor and supplier costs, equipment costs and supplemental costs. The proposal shall include sales tax. Where a change in Contract Time is sought, the proposal shall include a detailed schedule analysis demonstrating the impact to the controlling item(s) in the schedule. With respect to work during other than normal hours, the labor charges associated with such work shall consist of straight time wages and burden plus the appropriate overtime or shift premium with no additional burden (i.e. fringe benefits) on the premium portion.

The submittal shall cover all aspects of the Work involved, whether deleted, added or revised. Amounts for subcontractors or suppliers of any tier shall be similarly supported.

No submittal for an adjustment in Contract Price or Contract Time shall be valid unless submitted in accordance with this Section.

The Contractor is required to comply with the Construction Manager's documentation requirement regarding format and level of detail for the change order process.

The Owner reserves the right to direct the Contractor to solicit competitive bids for additional work. If required by Owner, the Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner who will determine, with the advice of the Engineer and Construction Manager, which bids will be accepted.

#### B. EXTRA WORK:

Extra work means the providing of materials and equipment and the performing of work not directly or by implication called for by the Contract. Changes in measured quantity under a unit price contract or item shall not be considered extra work. If the Owner requires extra work he may:

1. Do it himself,
2. Employ others to do it,
3. Direct the Contractor to perform the extra work at unit bid price or a combination of such items,
4. Direct the Contractor to perform the extra work at a mutually agreed upon lump sum, or
5. Direct the Contractor to perform the extra work on a time and expense basis, or
6. Direct the Contractor to perform the extra work at a lump sum amount determined by the Owner. Such lump sum amount determined by the Owner may be subject to appeals provisions of Article 2.05 of these General Conditions.

C. OMITTED WORK:

The Owner may, by written order to the Contractor, omit work, equipment and material to be provided under the Contract, and the value of the omitted work, equipment and material, including allowances for overhead and profit as described in paragraph 00 72 00-7.03.E, will be deducted from the Contract Price. The deducted value will be a lump sum or unit bid price agreed upon in writing by the Contractor and Owner based on breakdown and cost information submitted by the Contractor and will be deducted from the Base Bid amount of the Contract Price and added to the contract allowances amount.

D. UNIT BID PRICE CHANGE:

Increases or decreases in the quantity of a Contract item of Work will be made by comparing the total pay quantity of such item of Work with the Construction Manager's estimate therefore. When changes in quantities exceed 25 percent above or below the original bid quantity and the total dollar change of that bid item is significant, the Owner will review the unit price to determine if a new unit price should be negotiated. Adjustment in the unit price shall be applied only to the quantities above 125 percent or below 75 percent of the estimated quantity. The total payment for any item adjusted for decreased quantity shall not exceed 75 percent of the total amount originally bid for the item.

E. LUMP SUM CHANGES:

Changes in the Base Bid amount or the Contract Price resulting from extra work will be determined by a mutually agreed upon lump sum price. The Contractor's proposal for such changes shall be as outlined in paragraph 00 72 00 - 7.03.A.3. Construction equipment costs shall be computed as outlined in paragraph 00 72 00 - 7.03 F.5.

If the change involves extra work to be performed entirely by the Contractor, compensations for such extra work shall be based on the direct costs as listed in the detailed proposal, plus 15 percent of direct costs for overhead and profit, plus 1 percent of such direct costs for bond. When the extra work involves subcontractors, compensation for such work shall be based on direct costs as listed by the subcontractor plus 15 percent of such direct costs for the subcontractor's overhead and profit. The Contractor may add 5 percent to the subcontractor proposal for overhead and profit, and 1 percent for bond. The 5 percent subcontractor markup shall be applied only once regardless of the number of tiers of subcontractors. The above allowances for overhead and profit shall include full compensation for overhead, including superintendence, and additional overhead attributable to a time extension granted because of the change order. For extra work that is funded from contract allowances, the 1 percent additional cost for bonds shall not be applied.

F. TIME AND EXPENSE CHANGES:

1. General: Whenever the Contractor is directed to perform extra work on a time and expense basis, he has a duty to control costs and to maintain accurate records. Each day a record of labor, materials and equipment costs will be submitted to the Construction Manager for verification. These records will reflect the actual and necessary expenses pertaining to the extra work and shall be available for audit. Audits conducted under this provision shall be in accordance

with generally accepted auditing standards and established procedures and guidelines of the reviewing or audit agencies.

Payment to the Contractor for extra work performed on a time and expense basis shall consist of the actual necessary expense for doing the extra work, plus an allowance of 15 percent of labor, material and equipment rental for overhead, general superintendence and profits, plus 1 percent for bond. This basis of payment applies to work done directly by the Contractor and to work done by a subcontractor, except the 1-percent allowance for bond shall not apply to work performed by a subcontractor. When a subcontractor does the work, the Contractor may add 5 percent to the subcontractor's charges to cover overhead and profit and 1 percent for bond. For extra work that is funded from contract allowances, the 1 percent additional cost for bonds shall not be applied.

In determining time and expense compensation, the term "actual necessary expense" shall mean the sum of:

- a. Materials,
- b. Labor,
- c. Supervision,
- d. Construction equipment,
- e. Professional services, and
- f. Other costs.

Charges for such items shall mean the actual cost whether incurred by the Contractor, a subcontractor or others. The items making up "actual necessary expense" are defined as follows.

2. Materials:

- a. For materials accepted by the Construction Manager and used as an integral part of the finished Work, Contractor shall receive the actual cost of such materials delivered to the Work site, including transportation charges paid by the Contractor, exclusive of machinery rentals as hereinafter set forth.
- b. If materials are procured by Contractor by a method that is not a direct purchase from and a direct billing by the actual supplier, the cost of such material shall be deemed to be the lowest current wholesale price at which such materials are available in the quantities concerned and delivered to the site of the Work.
- c. For other materials used in the construction that are not an integral part of the finished Work, such as but not limited to sheeting, false work and form lumber, Contractor shall be reimbursed in the amount agreed upon by the Construction Manager before such work is begun. The salvage value of such material shall be taken into consideration in determining the amount of reimbursement.

3. Labor:
  - a. The cost of labor shall be the sum of actual wages, labor surcharge, and subsistence and travel allowances. Actual wages paid shall include employer payments to or on behalf of the worker for health and welfare, pension, vacation and similar purposes. The labor surcharge includes applicable labor related taxes, Workers Compensation Insurance premiums, public liability and property damage insurance premiums, and other legally required costs directly related to labor. Where subsistence and travel allowance are required for performance of extra work, the charges shall consist of the actual amount paid to each worker for these items.
  - b. For all labor and for authorized foreman supervision in direct charge of the specific operations, Contractor shall receive the actual rate of wage in effect at the time the work is performed for each and every hour that said labor force is actually engaged in such work.
  - c. The charges for labor shall NOT include charges for such overhead personnel as assistant superintendents, superintendents, office personnel, timekeepers, QA/QC manager, safety manager and maintenance mechanics.
4. Supervision: If, in the Owner's judgment, full-time supervision of the extra work above the level of foreman is required, it will be authorized in writing by the Construction Manager and charges for such supervision will be included as an actual necessary expense.
5. Construction Equipment:
  - a. Individual pieces of equipment or small tools having a replacement value of \$500 or less shall be considered expendable and no payment therefor shall be made.
  - b. Contractor shall be paid for the use of Contractor-owned or rented equipment at seventy percent of the suggested monthly rental rates listed for such equipment in the Rental Rates for Construction Equipment Blue Book (published by Equipment Watch, PRIMEDIA), except as modified below, which edition shall be the latest edition in effect at the time of commencement of the time and expense work. Hourly rental rates shall be calculated by dividing the listed monthly rates by 176 hours. The rental rate of equipment used in excess of eight hours per day shall be fifty percent of the hourly rates as calculated above. The rental rates for standby equipment, when authorized by the Construction Manager, shall be at the rate of fifty percent of the hourly rate for equipment in use eight hours per day. No payment for standby equipment shall be made for more than eight hours per day and no payment shall be made for weekend days or legal holidays. No payment for standby equipment shall be made when the equipment has been used at least eight hours in a 24-hour period. If it is deemed necessary by the Contractor to use equipment not listed in the applicable edition of the Blue Book Rental Rates, Contractor shall furnish the necessary cost data and paid invoices to the Construction Manager for his use in establishment of such rental rate(s).

- c. Equipment must be in good operating condition. The rates paid for operating the equipment shall be in addition to the rental rates identified above and shall be calculated at one-hundred percent of the operating rates as provided for in the Rental Rates for Construction Equipment Blue Book (published by Equipment Watch, PRIMEDIA). The operating costs shall cover the costs of fuel, oil, lubricants, supplies, small tools, necessary attachments, repairs and maintenance of all kinds, and all incidentals. The Contractor will be paid the equipment operating rate only for those hours the equipment is actually used. No payment of operating costs shall be made for standby equipment.
  - d. The rental time to be paid for equipment on the Work site shall be the time the equipment is required for the time and expense work being performed. The time shall include the time required to move the equipment to the location of the time and expense work and return it to the original location or to another location. Moving time will not be paid if the equipment is used at the site of the time and expense work on other than such time and expense work. Loading and transporting costs will be allowed, in lieu of the moving time, when the equipment is moved by means other than its own power. No payment for loading and transporting will be made if the equipment is used at the site of the time and expense work on other than such time and expense work. Compensation will not be allowed while equipment is inoperative due to breakdown.
  - e. For the use of equipment moved in on the Work and used exclusively for work paid for on a time and expense basis, providing the Construction Manager has agreed to such move, Contractor will be paid the equipment use rate provided for herein, for the costs of transporting the equipment to the location of the Work and its return to its original location, and for the cost of loading and unloading the equipment, all in accordance with the following provisions:
    - 1) The cost for transporting equipment shall not exceed the applicable minimum established rates by the Georgia Public Service Commission.
    - 2) The equipment use period shall begin at the time the equipment is unloaded at the site of the Work and shall include each day the equipment is at the site of the Work excluding weekends and legal holidays unless the time and expense work is performed on those days and shall terminate at the end of the day on which the Construction Manager instructs the Contractor to discontinue the use of such equipment. The maximum time to be paid per day shall not exceed eight hours unless the equipment is in operation for a longer time.
6. Subcontract Work: Where the Change applies to work being performed under a subcontract, reimbursement, including overhead and profit for the subcontractor's work performed on a time and expense basis shall be computed in precisely the same manner as if performed by Contractor. One additional allowance of five percent of the subcontractor's total costs will be granted to Contractor for overhead and profit regardless of the tier of the subcontractor.

If the subcontractor elects to contract out changed work to a third (or lower) level contractor or supplier of purchased equipment, he shall not be entitled to fees, overhead or profit for such third (or lower) level work or materials.

The Owner reserves the right to direct the Contractor to contract directly with a

third (or lower) level subcontractor or supplier of purchased equipment in order to avoid paying multiple fees, overhead and profit for such third (or lower) level subcontractor or supplier of purchased equipment.

If similar work is not being performed at the Work site and if required by the Construction Manager, Contractor shall obtain three competitive bids for the requirements of the Change and the Contract Documents from subcontractors acceptable to the Construction Manager. Selection of the subcontractor shall be subject to the approval of the Construction Manager and the Owner.

7. Professional Services: Professional services shall be included in "actual necessary expense" provided both the Owner has determined that such services are necessary and the Construction Manager has authorized in writing the provision of such services.
8. Other Costs: Charges for items not included in paragraphs 7.03 F.1 through 7 may be included as "actual necessary expense" if such additional items are authorized in advance and in writing by the Construction Manager.
9. Compensation: The compensation as set forth above shall be received by the Contractor as payment in full for work done on a time and expense basis. At the end of each day, the Contractor and Construction Manager shall compare records of the work performed including classification of laborers, ordered on a time and expense basis.
10. Statements: No payment shall be made for work performed on a time and expense basis until Contractor furnishes the Construction Manager itemized statements of the cost of such time and expense work. Time and expense work lasting more than one day shall require the Contractor to submit and receive the approval of the itemized statements, detailed to the satisfaction of the Construction Manager as to its contents. The itemized statements will typically include:
  - a. Labor – Name, classification, date, daily hours, total hours, rate and extension of each laborer and foreman.
  - b. Equipment – Size, type, identification number, date, daily hours, total hours, rental rate and extension of each unit of machinery and equipment.
  - c. Materials – Quantities of supplies and materials, prices including transportation costs and extensions.
  - d. Bonds and insurance premiums, as applicable.
  - e. Subcontract work – time and expense details as above, or progress quantities and prices of unit price or lump sum subcontracts.
  - f. Payment for items listed above shall be conditioned upon Contractor's presentation of original receipted invoices for materials used and transportation charges. If, however, the materials used in the time and expense work are not specially purchased for such work but are taken from Contractor's stock, then in lieu of the original invoices, the statements shall contain or be accompanied by an affidavit of Contractor that shall certify that

such materials were taken from his stock and that the price and transportation of the material as claimed represents actual cost.

11. If, in the Construction Manager's opinion, Contractor or any of his subcontractors, in performing time and expense work, is not making efficient use of labor, material or equipment and/or is proceeding in a manner that is expensive to the Owner, the Construction Manager may request the Contractor to make more efficient use of labor, material and equipment. Contractor shall in good faith comply with such requests as are reasonable. If the Contractor fails to comply with such requests, the Construction Manager may independently determine the reasonable cost for the work and the Contractor will be entitled only to such costs.

#### G. CHANGES IN CONTRACT TIME

1. Critical Path Schedule Analysis: An extension in Contract Time will not be granted unless the Contractor can demonstrate through an analysis of the critical path method progress schedule that the increases in the time to perform the Work beyond the Contract Time arise from causes beyond the control of the Contractor and his/her subcontractors or suppliers. The Contractor must demonstrate that such causes lead to completion of the Work beyond the corresponding Contract Time, despite the Contractor's reasonable and diligent actions to guard against those effects.
2. Avoidable Delays: The Owner may grant an extension of time for avoidable delay if he deems it in his best interest. If the Owner grants an extension of time for avoidable delay, the Contractor agrees to pay actual costs, including charges for engineering, construction management, inspection, and administration, as specified in paragraph 00 72 00-7.05 incurred during the extension.
3. Unavoidable Delays: For delays that the Contractor considers to be unavoidable, he/she shall submit to the Construction Manager complete information demonstrating the effect of the delay on the controlling item in his/her construction schedule. The Construction Manager shall review the Contractor's submission and determine the number of days of unavoidable delay and effect of such on controlling operations of the Work. The Owner will grant an extension of time to the extent that unavoidable delays affect controlling operations in the construction schedule. During such extensions of time, engineering, construction management, inspection and administration costs, nor damages for delay will be charged to the Contractor. It is understood and agreed by the Contractor and Owner that time extensions due to unavoidable delays will be granted only if such unavoidable delays involve controlling operations that would prevent completion of the whole Work within the specified Contract Time.
4. Use of Float: Total float and Contract float are not for the exclusive benefit of the Contractor, but is an expiring resource available to the Owner, Construction Manager, Engineer, their consultants, or the Contractor, to accommodate changes in the Work, however originated, or to mitigate the effects of events that may delay performance or completion of all or part of the Work within the scheduled late dates, the Contractor's anticipated completion, or Contract Time. Contract Time extensions for Contract performance will be granted only to the

extent that delays or disruptions to affected work paths exceed total float along those paths when the baseline or revised baseline schedule is compared against the working schedule in effect at the time of delay or disruption and will be limited to those provisions related to the extension of time identified within this Section. Delays and disruptions must cause the end date of the Work to exceed the Contract completion date and must be beyond the control and without fault or negligence of the Contractor or any subcontractor or supplier of any tier to be considered for time extension. In the event that the delays or disruptions impact an already negative float path, the Contractor shall not receive a time extension unless and until the activity with the highest negative float is driven even further negative. Delays or disruptions are not considered a basis for time extension to this Contract unless such delays or disruptions qualify for time extensions as set forth within this Section.

#### H. ALLOWANCES

The amounts listed in the Bid Form for designated Allowance Items are part of the Contract Price; however the use of these funds will follow the procedures set forth herein for Changes in the Work. If the item involves Owner-initiated work, a request for proposal will be issued to the Contractor and, following receipt and review of the proposal and negotiation of the scope of work and cost, a Directive will be issued. If the work involves the response to eligible unforeseen conditions, the scope of the work and method of payment will be determined by the Construction Manager following notification by the Contractor and an assessment of the situation.

##### 7.04 CHARGES TO CONTRACTOR

The Contractor shall pay everything charged to the Contractor under the terms of this Contract to the Owner on demand. Such charges may be deducted by the Owner from money due or to become due to the Contractor under the Contract. The Owner may recover such charges from the Contractor or from his surety.

##### 7.05 COMPENSATION TO OWNER FOR TIME EXTENSION

The Owner, in exchange for granting an extension of time for avoidable delay, shall be compensated by the Contractor for the actual costs to the Owner of engineering, construction management, inspection, and administration expenses which are directly chargeable to the work and which accrue during the period of such extension. The actual costs do not include charges for final inspection and preparation of the final estimate by the Owner.

**\*\* END OF SECTION \*\***

SECTION 00 73 16

INSURANCE REQUIREMENTS FOR CONTRACTORS

The Contractor shall procure and maintain for the duration of the Contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with performance of the work hereunder by the Contractor, his agents, representatives, employees, or subcontractors.

Attention: The Contractor is advised that certain provisions contained herein require specific endorsements of your insurance policy. Do not assume that your standard policy will be suitable to meet the requirements of Cobb County. The submittal of incomplete or non-conforming documents will delay the execution of the Contract/Agreement and the issuance of the Notice-to-Proceed for the Project.

**1. MINIMUM LIMITS OF INSURANCE**

- A. Statutory Workers' Compensation Insurance. The statutory limits as established by the General Assembly of the State of Georgia shall be met by Contractor and/or subcontractor. The workers' compensation policy must include Coverage B - Employer's Liability with minimum limits of:

Bodily Injury by Accident -\$1,000,000 each accident

Excess liability coverage may be used in combination with the base policy to obtain these limits. The Contractor shall require all subcontractors, of any tier, performing work under the contract to obtain an insurance certificate showing proof of Workers' Compensation and Employers Liability Coverage or shall certify that the subcontractors are covered by the Contractor's insurance.

- B. Commercial General Liability Insurance. The Contractor shall procure and maintain a Commercial General Liability Insurance Policy covering bodily injury, property damage liability and personal injury. The policy or policies must be on an "occurrence" basis ("Claims Made" coverage is not acceptable) insuring personal injury and property damage against the hazards of premises and operations, products and completed operations, blasting and explosion, collapse, underground damage, independent contractor's and contractual liability (specifically covering the indemnity) and have the minimum limits of liability listed below. The Commercial General Liability policy shall also include contractual liability coverage. The Commercial General Liability policy must include separate aggregate limits per project. Excess liability coverage may be used in combination with the base policy to obtain the following limits.

Premises and Operations	\$1,000,000 per Occurrence
Products and Completed Operations	\$1,000,000 per Occurrence
Personal Injury	\$1,000,000 per Occurrence
Contractual	\$1,000,000 per Occurrence

- C. Auto Liability Insurance. The Contractor shall procure and maintain a Business Automobile Liability Policy with liability limits of not less than \$1,000,000 per person and \$1,000,000 per occurrence or a policy with a Combined Single Limit of not less than \$1,000,000 covering any owned, non-owned or hired autos. Excess

liability coverage may be used in combination with the base policy to obtain these limits. The form of coverage must be as follows and/or cover the following areas:

Comprehensive form covering all owned, non-owned, leased, hired, and borrowed vehicles  
Additional Insured Endorsement  
Contractual Liability

- D. Commercial Umbrella Liability Insurance. The Contractor shall provide Commercial Umbrella Liability Insurance to provide excess coverage above the Commercial General Liability, Commercial Business Automobile Liability, and the Workers' Compensation and Employers' Liability to satisfy the minimum limits set forth herein. The Umbrella coverage shall follow form with the Umbrella limits required as follows:

\$5,000,000 Combined Single Limits per Occurrence

- E. Builder's Risk Insurance. The Contractor shall secure "All-Risk" type of Builder's Risk insurance covering work performed under the Contract, and materials equipment or other items to be incorporated therein, while the same are located at the construction site, stored off-site, or at the place of manufacture. The policy limit shall be for 100% of the value of the Contract. The policy shall cover not less than losses due to fire, flood, explosion, hail, lightning, weather, vandalism, malicious mischief, wind, collapse, riot, aircraft, smoke or other cataclysmic events, until the date of final acceptance of the work.

The making of progress payments to the Contractor shall not be construed as relieving the Contractor or his subcontractors or the insurance company or companies providing the coverage described herein of responsibility for loss or direct physical loss, damage or destruction occurring prior to final acceptance.

## 2. OTHER INSURANCE PROVISIONS

The policies are to contain, or be endorsed to contain, the following provisions:

- A. Additional Insured Endorsement – General Liability, Automobile Liability, and Umbrella Liability
1. The "Owner, Construction Manager, Engineer and their respective officers, officials, employees, and volunteers" are to be covered as Additional Named Insureds as respects all liabilities to be insured against by the policies described in Subsections 1.B, 1.C, and 1.D above.
  2. The coverage shall contain no special limitation on the scope of protection afforded to the Owner, Construction Manager, Engineer and their respective officers, officials, employees, or volunteers. Nothing in this paragraph shall be construed to require the Contractor to provide liability insurance coverage to the Owner, Construction Manager, or Engineer for claims asserted against the Owner, Construction Manager, or Engineer for their sole negligence.
  3. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

4. Provide a separate endorsement for each policy, signed by the authorized agent and citing individual policy numbers.
  5. The coverage shall be primary and shall contain no special limitations on the scope of protection afforded to the Certificate Holder/Additional Insured.
  6. In lieu of a separate endorsement, a copy of the declaration page for the Umbrella Liability Policy may be provided, listing the policy numbers for each type of insurance covered by the Umbrella.
- B. Waiver of Subrogation Endorsement – Workers' Compensation and Employers' Liability Coverage
1. The insurer shall agree to waive all rights of subrogation against the Owner, Construction Manager, Engineer and their respective officers, officials, employees, and volunteers for losses arising from work performed by the Contractor for the Owner under the Contract.
  2. Provide a separate endorsement for the policy, signed by the authorized agent and citing individual policy number.
- C. Notice of Cancellation Endorsements – General Liability, Automobile Liability, Umbrella Liability, and Workers' Compensation
1. Each insurance policy shall be endorsed to state that should any coverage be suspended, voided, cancelled or reduced in coverage or in limits, thirty days prior written notice will be given to the Certificate Holder. Notice of cancellation for non-payment of premium shall be not less than ten days.
  2. Provide a separate endorsement for each policy, signed by the authorized agent and citing individual policy numbers.
  3. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the Owner, Construction Manager, Engineer and their respective officers, officials, employees, or volunteers.
- D. Deductibles and Self-insured Retentions

Any deductibles or self-insured retentions must be declared to and approved by the Owner. At the option of the Owner, either the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the Owner, Construction Manager, Engineer and their respective officers, officials, and employees; or the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

All deductibles shall be paid by the Contractor.

E. Failure of Insurers

The Contractor is responsible for any delay resulting from the failure of its insurance carriers to furnish proof of coverage in the prescribed form. The summary table shown below in paragraph 4.C can serve as a checklist to confirm the submittal of

all required endorsements.

F. Contractor's Property and Equipment

The Contractor is responsible for insuring its own property and equipment.

**3. ACCEPTABILITY**

- A. The insurance purchased by the Contractor must be issued by a company licensed by the Insurance Commissioner to transact business in the State of Georgia or by a company acceptable to the State if the company is an alien insurer.
- B. Insurance is to be placed with insurers with a Best Policyholders Rating of "A" or better and with a financial size rating of Class VII or greater, or be otherwise acceptable to the Owner.

**4. VERIFICATION OF COVERAGE**

- A. The Contractor shall furnish the Owner with four original Certificates of Insurance, each with endorsements effecting coverage required by this Section of the Contract Documents. The certificates and endorsements for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.
- B. The insurance certificate must provide the following:
  - 1. Name and address of authorized agent.
  - 2. Name and address of insured. Name of insured must appear exactly as shown on Contractor's seal on Contract with Owner.
  - 3. Name of insurance company(ies).
  - 4. Description of policies.
  - 5. Policy number(s).
  - 6. Policy period(s).
  - 7. Name and address of Owner as Certificate Holder (see Subsection D below).
  - 8. Cobb County Water System Program Name and Number.
  - 9. Signature of authorized agent.
  - 10. Telephone number of authorized agent.
- C. The required endorsements to be submitted are summarized in the following table:

**ENDORSEMENT SUMMARY TABLE**

<b>Type of Insurance</b>	<b>Endorsement</b>
General Liability	Owner, etc. as Additional Insured
General Liability	Notice of Cancellation
Automobile Liability	Owner, etc. as Additional Insured
Automobile Liability	Notice of Cancellation
Umbrella Liability	Owner, etc. as Additional Insured <sup>1</sup>
Umbrella Liability	Notice of Cancellation <sup>1</sup>
Workers' Compensation	Waiver of Subrogation
Workers' Compensation	Notice of Cancellation

<sup>1</sup>Declarations pages may be submitted for Umbrella policies.

D. The Certificate Holder must be shown as:

Cobb County, Georgia  
Attention: Cobb County Water System  
Engineering & Records Division  
660 South Cobb Drive  
Marietta, GA 30060-3105

E. The certificates and endorsements naming additional insureds and indicating required waivers are to be submitted with the executed Agreement/Contract and Performance and Payment Bonds, for approval by the Owner before work commences. The Owner reserves the right to require the submittal of complete, certified copies of all required insurance policies at any time.

## **5. SUBCONTRACTORS**

Contractor shall include all subcontractors as additional insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. Coverage for subcontractors shall be subject to all of the requirements stated herein. Owner may request evidence of subcontractor's insurance. Contractor shall ensure that all subcontractors comply with the insurance requirements and provisions of this Section.

**\*\* END OF SECTION \*\***

SECTION 00 73 17  
BUSINESS LICENSE

Attention is drawn to Section 78-31 of the Official Code of Cobb County, Georgia which reads as follows:

**Sec. 78-31. Scope and Levy.**

- (a) *Generally.* Pursuant to O.C.G.A. § 36-1-22, O.C.G.A. § 48-13-6 et seq., the authority of 1986 Ga. Laws (Act No. 1364), page 5450, and H.B. 175, 1995 Ga. Laws, page 419 et seq., all persons, including professional corporations, engaged in business in the unincorporated area of the county are hereby required to register their business or office and obtain a business registration certificate therefore, and pay the amount now or hereafter fixed as the occupation tax thereon. The occupation tax levied in this section is for revenue purposes only and is not for regulatory purposes. The occupation tax applies only on businesses and occupations which are covered by the provisions of O.C.G.A. §§ 48-13-5 through 48-13-26. Other applicable businesses and occupations are subject to county taxes pursuant to pertinent general law and/or county ordinance.
- (b) *Businesses with no location or office in state.*
- (1) The provisions of this article shall apply to those businesses and practitioners of professions and occupations with no location or office in the state if the business or practitioner:
- a. Has one or more employees or agents who exert substantial efforts within the unincorporated part of the county for the purpose of soliciting business or serving customers or clients; or
- b. Owns personal or real property which generates income and which is located in the unincorporated part of the county.
- (2) In no event shall a business or practitioner subject to this subsection be required to pay an occupation tax to more than one local government in the state and then only to the local government in which the largest dollar volume of business is done or service is performed by the individual business or practitioner.
- (3) If a business or practitioner subject to this subsection provides to the supervisor of the business license office proof of payment of a local business or occupation tax in another state, or county or municipality of this state which purports to tax the business's or practitioner's sales or services in this state, the business or practitioner shall be exempt for the levy of any occupational tax under this section.
- (c) *Permit for persons exempted from paying tax.* Even though a person may be exempt under state or other law from paying an occupation tax, nevertheless, such person must apply to the business license office for a free permit to engage in or carry on any business provided for in this article and submit proper and lawful credentials exempting applicant from paying the occupation tax.

(Ord. of 10-25-94; Code 1977, § 3-7-1(a)--(c); Ord. of 6-27-95(1))

**State law references:** General authority to levy occupation tax, O.C.G.A. §§ 48-13-5--48-13-9.

\*\* END OF SECTION \*\*

SECTION 00 73 18

COBB COUNTY SUBCONTRACTOR NOTIFICATION LIST

List the name, address, and Business License number for each subcontractor that may perform work on this Project. Indicate whether or not the subcontractor is a Disadvantaged Business Enterprise. All Subcontractors must be reported on this form for License Inspection purposes. Submit this form with the Agreement, Bonds, and Insurance Certificates at the time of Contract execution. This information will be forwarded to the Cobb County Business License Division.

CONTRACTOR/DEVELOPER: \_\_\_\_\_

BUSINESS LICENSE NO.: \_\_\_\_\_

PROJECT LOCATION: \_\_\_\_\_

PROJECT IMPLEMENTATION DATE: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

SUBCONTRACTOR: \_\_\_\_\_

BUSINESS LICENSE NO.: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\* DBE? Yes \_\_\_ No \_\_\_ (If Yes, approx. percent of Contract Amount \_\_\_%)

SUBCONTRACTOR: \_\_\_\_\_

BUSINESS LICENSE NO.: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\* DBE? Yes \_\_\_ No \_\_\_ (If Yes, approx. percent of Contract Amount \_\_\_%)

SUBCONTRACTOR: \_\_\_\_\_

BUSINESS LICENSE NO.: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\* DBE? Yes \_\_\_ No \_\_\_ (If Yes, approx. percent of Contract Amount \_\_\_%)

SUBCONTRACTOR: \_\_\_\_\_

BUSINESS LICENSE NO.: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\* DBE? Yes \_\_\_ No \_\_\_ (If Yes, approx. percent of Contract Amount \_\_\_%)

\* DBE (Disadvantaged Business Enterprise)

SECTION 01 11 00  
SUMMARY OF WORK

1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- A. The work to be performed under this Contract shall consist of furnishing all labor, materials, tools, equipment, and incidentals and performing all work required to construct complete in place and ready to operate the Noonday Creek WRF Chemical Systems Upgrade project.
- B. In general, the Noonday Creek WRF Chemical Systems Upgrade project will consist of the following major components.
1. Install temporary chemical feed facilities for the existing ferrous chloride, sodium hypochlorite, and sodium bisulfite chemical feed systems.
  2. Demolish existing ferrous chloride feed system including bulk storage tanks, chemical feed pumps, control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  3. Demolish existing sodium hypochlorite feed system including bulk storage tanks, chemical feed pumps, control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  4. Demolish existing sodium bisulfite feed pumps, control panels, associated piping, and appurtenances.
  5. Demolish other chemical pumps and appurtenances as specified.
  6. Remove and replace existing chemical piping between bulk storage tanks and chemical feed building.
  7. Remove and replace existing ferrous chloride, sodium hypochlorite, and sodium bisulfite distribution pipe between chemical feed building and discharge locations.
  8. Install new ferrous chloride feed equipment including bulk storage tanks, peristaltic hose pumps, pump control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  9. Install new sodium hypochlorite feed equipment including bulk storage tanks, peristaltic hose pumps, pump control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  10. Install new sodium hydroxide peristaltic hose pump, pump control panel, chemical piping, electrical conduit and wiring, and appurtenances.
  11. Install new sodium bisulfite peristaltic hose pumps, pump control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  12. Remove existing safety eyewash/shower stations and install new safety eyewash/shower stations.
  13. Remove and dispose of two abandoned chemical storage tanks, in addition to tanks above.
  14. Erosion and sediment control, site cleanup, and all other activities required to complete the project.

1.2 PROJECT LOCATION

- A. The project site is located at 415 Shallowford Road, Kennesaw, GA 30144.

\*\* END OF SECTION \*\*

SECTION 01 22 15  
MEASUREMENT AND PAYMENT

1 GENERAL

1.1 DESCRIPTION

- A. Unless otherwise stated in individual sections of the Specifications or in the Bid Schedule, no separate payment will be made for any item of Work, materials, parts, equipment, supplies or related items required to perform and complete the Work. The costs for all such items required shall be included in the Contract price bid for item of which it is a part.
- B. Payment will be made based on the specified items included in the description for each bid item in the Bid Schedule.
- C. Required items of Work and incidentals necessary for the satisfactory completion of Work which are not specifically listed in the Bid Schedule, and which are not specified in this Section to be measured or included in one of the items listed in the Bid Schedule shall be considered incidental to the Work.
- D. All excavation is bid unclassified and all costs associated with excavation shall be included in the lump sum bid price.
- E. Payment for the various items in the Bid Form shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, taxes, materials, commissions, transportation and handling, bonds, permit fees, insurance, overhead and profit, and incidentals appurtenant to the items of Work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Bidding Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). Such compensation shall also include payment for any loss or damages arising directly or indirectly from the Work.
- F. Work includes furnishing all labor, equipment, tools and materials and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings.

1.2 MEASUREMENT AND PAYMENT

- A. Lump Sum – Noonday Creek Water Reclamation Facility Chemical Systems Upgrade, complete, in accordance with the work described in the Contract Documents, including all work shown on the Drawings and as specified, exclusive of those items listed in Item 2 – Extra Work Allowance.
  - 1. Measurement: Shall be in accordance with the accepted Schedule of Values.
  - 2. Payment: Progress payments shall be based on the actual percentage of Work satisfactorily completed during the progress payment period in accordance with the approved Schedule of Values. Final payment shall be the balance of the stated Lump Sum as adjusted by approved change orders.
- B. Extra Work Allowance, for additional work as described by the Engineer and authorized by the Owner. Any unexpended balance of the Allowance amount shall revert to the Owner at the conclusion of the Contract. The Contractor shall not be allowed an adjustment in overhead and/or profit based on unexpended portion of this Allowance Item.
  - 1. Measurement: Shall be in accordance with Section 00 72 00, General Conditions as directed by the Engineer and authorized by the Owner.
  - 2. Payment: Payment shall be in accordance with Section 00 72 00, General Conditions as directed by the Engineer and authorized by the Owner.

### 1.3 ALLOWANCES

#### A. General

1. The Contractor shall include in his proposal the allowance amount(s) listed below.
2. The allowance(s) shall cover work, manufactured equipment or services that will be provided either by the Contractor or by others who may be selected by the Owner. All work performed under allowance(s) will be eligible for payment only with the Owner's prior written approval, and under special terms described herein.
3. Subcontract Allowances: Authorized subcontract work that is performed by subcontractors to the General Contractor and paid for under Allowances is considered to be subcontract work to the Contractor. Payment to Contractor will be in accordance with Section 00 72 00, General Conditions.
4. Cash Allowances for Purchases and Purchased Services: Where Contractor purchases equipment or materials that are authorized to be paid from Allowances and installed or incorporated into the project, the Contractor's costs for unloading, handling, installation, overhead, profit, taxes, and other expenses are to be included in Contractor's Bid Price. This same provision will apply to Purchased Services by Owner from parties who are not a subcontractor to the Contractor.
5. The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. The Contractor's handling costs on the site, labor, installation costs, overhead, profit, taxes, and other expenses contemplated for the original allowance shall be included in the Contract Sum and not in the allowance. The Contractor shall cause work covered by these allowances to be performed for such amounts and by such persons as the Owner/Engineer may direct, but he will not be required to employ persons against whom he makes a reasonable objection. If the cost, when determined, is more than or less than the allowance, the Contract Sum shall be adjusted accordingly by Change Order.

#### B. Schedule of Allowances

1. The Contractor's Total Base Bid Price shall include an Extra Work Allowance of \$100,000 (Item No. 2 in Bid Schedule). This allowance will be for extra work as directed by the Owner. No payments will be made to the Contractor for extra work unless specific work items are negotiated and authorized by the Owner.

### 1.4 PAYMENT FOR MOBILIZATION

- A. Mobilization shall include the obtaining of all permits, moving equipment onto the site, furnishing and erecting temporary buildings and other construction facilities, and providing utility services, all as required for the proper performance and completion of the Work. No payment for mobilization or any part thereof will be approved for payment under the Contract until all mobilization items have been completed.
- B. The lump sum price for mobilization will be payable with the first progress payment request except that this initial payment will be limited to 5% of the total Contract amount. Any remaining amount will be paid when the value of the completed work exceeds 50% of the total Contract amount.

### 1.5 APPLICATIONS FOR PAYMENT

- A. Submit Applications for Payment to Engineer at the times agreed to in the pre-construction meeting.
- B. The accepted Schedule of Values shall be used as the basis for the Contractor's Application for Payment.
- C. No Application for Payment will be processed until the Contractor's Construction Progress Schedule and Schedule of Values (Section 01 32 16, Construction Progress Schedule) have been accepted by the Owner and the pre-construction audio/video recordings and progress photos have been submitted.
- D. Submit sales tax report as specified in Section 00 72 00, General Conditions, with each pay

request.

- E. Applications for Payment shall be submitted on 8½-inch by 11-inch white paper and in a form approved by the Owner and Engineer.
- F. Include executed change orders and allowance directives.
- G. Application for Payment must include pay request number, pay request date, period of payment, and signature of Contractor.
- H. Application for Payment shall include an overall summary sheet listing each of the items in the approved Schedule of Values along with the item's budget value, percent earned previously, amount earned previously, percent earned this period, amount earned this period, total percent earned to date, and total amount earned to date for each pay item.
- I. Payment for stored equipment and materials will be made in accordance with Section 00 72 00, General Conditions. Provide supplier/vendor invoices.
- J. After the Engineer reviews the Application for Payment and determines that it is properly completed and correct, the Contractor shall submit 5 signed originals to the Engineer. Engineer will then approve the Application for Payment and forward them to the Owner.
- K. When Owner or Engineer requires substantiating data, Contractor shall submit suitable information with a cover letter identifying:
  - 1. Project
  - 2. Application number and date
  - 3. Detailed list of enclosures
  - 4. For stored products:
    - a. Item number and identification as shown on application
    - b. Description of specific material
  - 5. Submit one copy of data and cover letter for each copy of application.

**\*\* END OF SECTION \*\***

SECTION 01 31 19  
PROJECT MEETINGS

1 GENERAL

1.1 PRECONSTRUCTION MEETING

- A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site.
- B. Attendance at preconstruction meeting will include, but not be limited to, the following.
  - 1. Owner
  - 2. Engineer
  - 3. Contractor
  - 4. Other parties, as necessary
- C. Minimum Agenda
  - 1. Tentative construction schedule
  - 2. Critical work sequencing
  - 3. Designation of responsible personnel
  - 4. Processing of Field Decisions and Change Orders
  - 5. Distribution of Contract Documents
  - 6. Submittal of Shop Drawings and samples
  - 7. Procedures for maintaining record documents
  - 8. Use of site and Owner's requirements
  - 9. Major equipment deliveries and priorities
  - 10. Safety and first aid procedures
  - 11. Security procedures
  - 12. Housekeeping procedures
  - 13. Processing of Partial Payment Requests

1.2 PROGRESS MEETINGS

- A. Progress meetings will be held monthly at a location chosen by the Owner during the performance of the work of this Contract. Additional meetings may be called as progress of work dictates.
- B. Engineer will preside at meetings and record minutes of proceedings and decisions. Engineer will distribute copies of minutes to participants.
- C. Attendance at progress meetings shall include the following.
  - 1. Owner
  - 2. Engineer
  - 3. Contractor
  - 4. Subcontractors, when pertinent to the agenda
- D. Minimum Agenda
  - 1. Review and approve minutes of previous meeting.
  - 2. Review progress of Work since last meeting.
  - 3. Review proposed 30-day construction schedule.
  - 4. Note and identify problems which impede planned progress.

5. Develop corrective measures and procedures to regain planned schedule.
  6. Review erosion and sedimentation measures.
  7. Revise construction schedule as indicated and plan progress during next work period.
  8. Review quality and work standards.
  9. Review work environment.
  10. Discuss status of Requests for Information, Submittals, Requests for Substitution, Proposals, and other project records.
  11. Complete other current business.
  12. Schedule next progress meeting.
- E. The Contractor shall bring record drawings to each progress meeting for review. Record drawings shall reflect all changes to date. Failure to keep up-to-date record drawings will result in not processing pay requests.
- F. The Contractor shall bring updated project schedules to each progress meeting for review. Updated project schedules shall reflect all changes to date. Failure to keep up-to-date project schedules will result in not processing pay requests.
- 1.3 CALLED MEETINGS
- A. The Owner or Engineer may request meetings with the Contractor at any time on matters pertaining to the progress of Work being carried out under this Contract. It will be the responsibility of the Contractor to supply whatever information is requested by the Owner or Engineer concerning the project throughout its duration.
- B. Contractor shall make manufacturer representatives and information available on request for meetings the Engineer has with the Owner.

\*\* END OF SECTION \*\*

SECTION 01 32 16  
CONSTRUCTION PROGRESS SCHEDULE

1 GENERAL

1.1 DESCRIPTION

- A. The Contractor shall submit to the Engineer for approval construction planning, scheduling, and cost value documentation pertaining to the project as detailed herein and shall update same throughout project as required.
- B. The following schedules, reports, and plots shall be submitted to the Engineer.
  - 1. Construction Progress Schedule
  - 2. Short Term Schedules
  - 3. Detailed Cost Breakdown/Schedule of Values
  - 4. Activity Reports
  - 5. Equipment and Material Order Schedule
  - 6. Logic Diagrams
  - 7. Resource Plots
- C. No Construction Progress Schedule review by the Engineer shall relieve the Contractor from the responsibility to comply with the Contract Times and any sequences of Work indicated in or required by the Contract Documents or to complete Work within the Contract Times. Nor will any such Construction Progress Schedule review by the Engineer lead to approval of, or consent to, any variation from the Contract Documents, except as the Engineer may otherwise approve or consent to individual variations by means of specific, separate notations in writing.

1.2 SUBMITTAL PROCEDURES

- A. Within 15 working days of Notice to Proceed, the Contractor shall submit to the Engineer for approval the products required by this section of the Specifications.
- B. Within 10 working days following receipt of same the Engineer shall arrange for a meeting with the Contractor so as to familiarize the Engineer with the Contractor's proposed construction plans and schedules.
- C. Within 10 working days following the Engineer's review the Contractor shall resubmit a corrected copy of those documents requiring revision.
- D. Within 10 working days following his receipt of the adequately revised documents the Engineer will approve same for use on the project.
- E. Once approved, the Contractor shall submit 4 copies of the construction scheduling documents to the Engineer for use on the project. The construction scheduling documents shall be marked Rev. 0.
- F. The Contractor shall not submit an Application for Payment until the Rev. 0 Construction Progress Schedule is approved and the Schedule of Values is approved.

2 PRODUCTS

2.1 GENERAL

- A. All construction scheduling documents shall be prefaced with the following summary data.
  - 1. Project Name
  - 2. Contractor
  - 3. Type of Tabulation (Initial or Updated with revision number)

4. Project Duration
5. Project Scheduled Completion Date
6. Effective or Starting Date of the Schedule
7. If an updated (revised) schedule, the new project completion date and project status

## 2.2 CONSTRUCTION PROGRESS SCHEDULE

- A. The Construction Progress Schedule shall be a cost-and-resource loaded critical path method (CPM) progress schedule.
- B. Microsoft Project, Primavera, or equivalent scheduling software shall be used. Spreadsheet type schedules using Microsoft Excel or other spreadsheet type programs are not acceptable.
- C. The Construction Progress Schedule shall detail CPM activities and logic ties to the extent required to show the Contractor's overall approach to the Work.
- D. At a minimum, the Construction Progress Schedule shall include the following.
  1. Activity Number
  2. Activity Description
  3. Estimated Activity Duration (Work Days)
  4. Activity Start Date (Calendar Dated)
  5. Activity Finish Date (Calendar Dated)
  6. Activity Cost of each of the various subdivisions of work required under the Contract Document, Specifications, and Drawings.
- E. The Construction Progress Schedule shall clearly define the prosecution of the Work from Notice-to-Proceed to Final Acceptance by using separate CPM Activities.
- F. CPM Activities shall equate to the days required to complete the associated work.
- G. CPM Activities shall be assigned consistent descriptions, codes, and sort codes.
- H. CPM Activity durations shall be depicted in the form of a bar chart.
- I. The narrative shall list the CPM Activities on each Critical Path and compare Early and Late Dates for CPM Activities designating Contract Times and Target Times. The narrative shall also recap progress and days gained or lost vs. the current Construction Progress Schedule, describe changes in resources to be used on remaining Work and identify delays, their extent and causes. The narrative shall also itemize changes in Activities, logic ties and detailed cost breakdown pay items by each change, recovery plan and Contractor-initiated revision.
- J. Construction Progress Schedules shall be in color, shall be submitted on 11"x17" white paper, and shall be submitted electronically in PDF format.
- K. Construction Progress Schedule Updates
  1. The Contractor shall update the Construction Progress Schedule at least monthly and indicate those activities whose completion dates are in jeopardy because of activities behind schedule.
  2. Updated construction scheduling documents shall be submitted to the Engineer each month at the construction progress meeting.
  3. Each monthly Construction Progress Schedule Update shall be marked Rev. 0.1, Rev. 0.2, etc.
  4. The Owner may require the Contractor to modify any portions of the work schedule that becomes infeasible because of "activities behind schedule" or for any other valid reason. Any such modification will be at the Contractor's expense unless the modification is required to accommodate schedule revisions required by the Owner.

5. If a revision is required to the Construction Progress Schedule Update submittal, it shall be marked Rev. 0.1A, Rev. 0.1B, etc.
  6. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule.
- L. If a revision is required to the overall Construction Progress Schedule, it shall be marked Rev. 2, Rev. 3, etc.

### 2.3 SHORT TERM SCHEDULES

- A. Short-Term Schedules shall subdivide CPM Activities into detailed tasks and cover the prior two (2) weeks and the next four (4) weeks. Each installation task shall be cross-referenced to a CPM Activity and shall not combine the Work for more than one crew. Submittals shall segregate preparation from review and shall not combine items furnished by separate Suppliers.

### 2.4 DETAILED COST BREAKDOWN/SCHEDULE OF VALUES

- A. Provide schedule of values in accordance with Section 00 72 00, General Conditions and this Section.
- B. The Detailed Cost Breakdown (DCB) shall divide the Work into pay items by significant Sections of the Specifications within areas, structures, and facilities, or vice versa. If requested by the Engineer in writing, there shall be separate DCB reports for self-performed Work and the Work of each Subcontractor.
- C. The Schedule of Values (SOV) shall subdivide the DCB into CPM and Pay Activities, sequenced by Activity codes, and shall tabulate for each Activity: code, description, Values for labor, Subcontract and/or materials and equipment costs; Activity Values; percent complete; and Earned Values. Delivery and Submittal review Activities, where appropriate, shall be cost-loaded if the Contractor intends to request payment for stored materials and for approved equipment Shop Drawings, respectively.
1. The Contractor shall establish and submit a cost value for each activity in his progress schedule and estimates so that monthly partial payments to the Contractor can be calculated on the basis of work in place.
  2. Wherever in the General Conditions it is provided that payments will be allowed for materials delivered to the site but not yet incorporated in the work, subject to the terms and conditions specified in the General Conditions, separate pay items shall be established for furnishing and installation of such items.
  3. Costs of materials delivered to the site but not yet incorporated into the work shall be included as a separate pay item and shall not be included in the cost value of the installation activity for such materials.
- D. Pay Activities or the features of the software shall be used to ensure that any total CPM Activity Value or, if appropriate, that any Activity labor, Subcontract, etc. Values roll up to only one DCB pay item. Once the Rev. 0 DCB and SOV are approved, the Contractor shall not modify any DCB pay item or Activity Value, unless otherwise authorized by the Engineer in writing.
- E. A schedule of the anticipated amount of each monthly payment that will become due the Contractor in accordance with the Construction Progress Schedule shall be provided. This anticipated monthly payment schedule shall distribute the costs of the project over the scheduled project life in a manner acceptable to the Owner and compatible with the Owner's funding arrangements for the project. Re-submittal will be required until the anticipated monthly payment schedule is acceptable to Owner.
- F. The SOV will be used as the basis for the Contractor's monthly Application for Payment.
- G. The sum of all values listed in the SOV shall equal the Contract sum.

### 2.5 ACTIVITY REPORTS

- A. Activity Reports shall include CPM Activity code, description, duration, calendar, Early and Late Dates (calendar dates), Total Float, labor manhours, and sort codes. The Late Finish

Date (or the Early Start Date) of any CPM Activity highlighting a Contract Time (or commencement of all or any part of the Work) shall equal the corresponding Contract Time (or Contract date). In addition, for precedence-based Progress Schedules, Activity Reports shall show, for each CPM Activity, all preceding and succeeding logic ties (lead/lag and lead times) or attach a separate report combining such Activity and logic tie data.

## 2.6 EQUIPMENT AND MATERIAL ORDER SCHEDULE

- A. Equipment and Material Order Schedule shall include the following information for principal items of equipment and materials.
1. Dates on which Shop Drawings are requested and received from the manufacturer
  2. Dates on which certification is received from the manufacturer and transmitted to the Engineer
  3. Dates on which Shop Drawings are submitted to the Engineer and returned by the Engineer for revision
  4. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer
  5. Date on which Shop Drawings are returned by Engineer annotated either "Furnish as Submitted" or "Furnish as Corrected"
  6. Date on which accepted Shop Drawings are transmitted to manufacturer
  7. Date of manufacturer's scheduled shop test
  8. Date of manufacturer's scheduled delivery
  9. Date on which delivery is actually made

## 2.7 LOGIC DIAGRAMS

- A. Logic Diagrams shall be arrow or precedence and, once the Engineer has designated time-scales, shall be plotted on a time- scaled calendar, on minimum 22-inch x 34-inch color sheets. Logic Diagrams shall identify the Contract Times and Critical Path(s). CPM Activities shall be shown on the Early Dates, and Total Floats shall be noted beside the CPM Activities. Logic connectors whether on the same sheet or not, shall identify predecessors and successors.

## 2.8 RESOURCE PLOTS

- A. Resource Plots shall graph monthly (or weekly, if chosen by the Engineer) and cumulative payments and manpower, using current Early Dates and Late Dates and, when requested by the Engineer, comparing Construction Progress Schedule and current Early Dates. The specific trades shall be chosen by the Engineer.

## 2.9 PROPOSAL SCHEDULES

- A. If required, the Contractor shall submit Proposal Schedules, which shall support proposals or claims for changes in Contract Price or Contract Time, schedule recovery plans and other Contractor-initiated Progress Schedule adjustments.
- B. A Proposal Schedule Submittal shall include all the reports, schedules, plots, etc. specified for a Progress Schedule Submittal.

# 3 EXECUTION

## 3.1 GENERAL

- A. Contractor shall take all reasonable actions to maintain the Rev. 0 Construction Progress Schedule.

## 3.2 DELAY PROVISIONS

- A. Refer to Section 00 72 00, General Conditions.

### 3.3 CHANGE ORDERS

- A. Upon approval of a Change Order by the Owner the approved change shall be reflected in the next submittal by the Contractor.

### 3.4 MEASUREMENT AND PAYMENT

- A. The Contractor represents to have included in the Contract Price all costs for Work under this Section. Payment for Work performed under this Section will be made as part of those payments made on in-progress and completed Detailed Cost Breakdown pay items, or using the Earned Values for Progress Schedule Submittal pay items, if any such pay items are established.

\*\* END OF SECTION \*\*

SECTION 01 32 26  
CONSTRUCTION PROGRESS REPORTING

1 GENERAL

1.1 DAILY REPORTS

- A. The Contractor shall submit construction progress reports to the Engineer daily. Reports shall contain, but not be limited to, the following information:
1. Summary of work completed that day
  2. A list of all employees and subcontractors by trade that worked on the job that day
  3. A list of all equipment and materials received
  4. Survey stake-out data collected
  5. Erosion control maintenance updates
  6. Summary of any critical events from the day, injury reports, etc.
  7. Any other information pertinent to the construction project

\*\* END OF SECTION \*\*

SECTION 01 32 33  
PHOTOGRAPHIC DOCUMENTATION

1 GENERAL

1.1 SCOPE

- A. Furnish all equipment, labor, and materials required to provide the Owner with digital construction photographs and audio/video recordings of the Project.
- B. Photos, electronic files, and audio/video recordings shall become the property of the Owner and none of which shall be published without express permission of the Owner.

1.2 PRE AND POST CONSTRUCTION PHOTOGRAPHS

- A. Prior to the beginning of any work, take project photographs of the work area to record existing conditions.
- B. Following completion of the work, take another set of photos showing the same areas and features as in the pre-construction photographs.
- C. Show all conditions which might later be subject to disagreement in sufficient detail to provide a basis for decisions.
- D. Submit the pre-construction photographs to the Engineer within 15 calendar days after the date of receipt by the Contractor of the Notice to Proceed. Provide post-construction photographs prior to final acceptance of the project.

1.3 PROGRESS PHOTOGRAPHS

- A. Include the date and time marking of the recording on the photographs. Electronically label all photographs to indicate date and description of work shown.
- B. Submit a minimum of 25 photographs with each request for payment. The view selection will be as agreed to with the Engineer. Submit on USB flash drives with copies of the electronic photograph files in jpeg format.

1.4 PRE AND POST CONSTRUCTION AUDIO/VIDEO RECORDINGS

- A. Prior to the beginning of any work, make audio/video recordings of the work area to record existing conditions.
- B. Following completion of the work, make another recording showing the same areas and features as in the pre-construction recording.
- C. Show all conditions which might later be subject to a disagreement in sufficient detail to provide a basis for decisions.
- D. Include the date and time markings on the video. Provide an audio narration, stating a description of what is shown, structure, area, approximate station of the area shown, and street address and property owner where appropriate for all videos.
- E. Use DVD minus R format for audio/video recordings. The quality and content shall be subject to the approval of the Engineer.
- F. Provide typed labels for the DVD and DVD case with the following information: Project title, date of recording, project stations shown on the recording.

1.5 SUBMITTALS

- A. Photo Quality
  - 1. 4.0 megapixels (2,240x1,680 resolution) or better with 48 Bit color depth.

B. Formats

1. Provide photo files on USB flash drives in jpeg format.
2. Provide audio/video recordings in DVD minus R format.

C. Submit the pre-construction photographs to the Engineer within 15 calendar days after the date of the Notice to Proceed. Submit post-construction photographs prior to final acceptance of the Project.

D. Submit progress photographs with each payment request.

E. Audio/Video Recordings

1. Submit the pre-construction recording prior to the first partial payment request.
2. Submit the post-construction recording with the final payment request.

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

**\*\* END OF SECTION \*\***

SECTION 01 33 23  
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

- A. The Contractor shall submit to the Engineer for review and approval complete drawings and engineering data for all equipment, materials, and products to be incorporated into the work. Shop drawings and engineering data shall be provided and the Engineer's review will be conducted in accordance with requirements of the General Conditions. The review of the drawings by the Engineer shall not be construed as a complete check but only for conformance with the contract documents. Review of such submittals will not relieve the Contractor of the responsibility for any errors that may exist, as the Contractor shall be responsible for the dimension and design of adequate connections, details, and satisfactory construction of all work.
- B. The term "submittals" shall mean shop drawings, manufacturer's drawings, catalog sheets, brochures, descriptive literature, diagrams, schedules, calculations, material lists, performance charts, test reports, office and field samples, and items of similar nature which are normally submitted for the Engineer's review for conformance with the design concept and compliance with the contract documents.
- C. Shop drawings and engineering data shall be prepared by the original equipment vendors or fabricators, as applicable.
- D. Each shop drawing and each item of engineering data shall bear the Contractor's approved stamp indicating that the Contractor has reviewed the drawing or data for conformance with the Contract Documents.
- E. All design calculations and drawings for sheeting and shoring and concrete formwork shall bear the signed and dated stamp of a licensed professional engineer.
- F. No material or equipment shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed and approved by the Engineer and returned to the Contractor. No payments will be made for materials or equipment that do not have approved shop drawings.

1.2 MISCELLANEOUS SUBMITTALS

- A. The Contractor shall submit to the Engineer miscellaneous information, procedures, test data, samples, etc., in the manner and at the time specified in these Specifications and Contract Documents. Miscellaneous submittals shall include, but not be limited to, the following:
  - 1. Satisfactory written evidence in the form of laboratory or mill test reports indicating that all cement, aggregate, masonry, castings, steel reinforcement, pipe, grout, grass seed, and other items incorporated into the work are in compliance with requirements of these Specifications.
  - 2. Project record documents.
  - 3. When requested, analysis and design data on concrete formwork and sheeting and shoring.
  - 4. Drawings and details of erosion and sediment control structures.

1.3 SAMPLES

- A. At the Engineer's request, the Contractor shall furnish certified samples of materials utilized in the fabrication or production of equipment, materials, and products supplied under these Contract Documents. Cost of all such samples shall be borne by the Contractor.

1.4 GENERAL SUBMITTAL REQUIREMENTS

- A. Scheduling

1. Where appropriate in various required administrative submittals (listings of products, manufacturers, supplier and subcontractors, and in job progress schedule), show principal work-related submittal requirements and time schedules for coordination and integration of submittal activity with related work in each instance.
- B. Coordination of Submittal Times
1. Prepare and transmit each submittal to the Engineer sufficiently in advance of performing related work or other applicable activities, so the installation will not be delayed or improperly sequenced by processing times, including non-approval and re-submittal (if required). Coordinate with other submittals, testing, purchasing, delivery and similar sequenced activities. No extension of time will be authorized because of Contractor's failure to transmit submittals to the Engineer sufficiently in advance of the work.
- C. Sequencing Requirements
1. As applicable in each instance, do not proceed with a unit of work until submittal procedures have been sequenced with related units of work, in a manner which will ensure that the action will not need to be later modified or rescinded by reason of a subsequent submittal which should have been processed earlier or concurrently for coordination.
- D. Preparation of Submittals
1. Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and provide space for the Engineer's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through the Contractor's office will be returned "without action."
- E. Submittal Format
1. Submittals shall be submitted in electronic PDF format. Submittals shall be scanned in color format. Text shall be on 8½-inch x 11-inch pages and drawings shall be on 11-inch x 17-inch pages. All pages shall be properly oriented so that they do not need to be rotated on the computer screen.
  2. Two (2) hard copies of each final approved submittal shall be submitted to the Owner.
- F. Transmittal Identification
1. Number transmittals in sequence for each Division of the Specifications. The number before the dash indicates the Section of the Specifications, and the number after the dash is the sequence number of the transmittal (XX XX XX-1 would be the first transmittal applicable to Section XX XX XX of the Specifications, XX XX XX-2 would be the second transmittal for Section XX XX XX, etc.)
  2. Identify re-submittals with a letter of the alphabet following the original number, using "A" for the first re-submittal, "B" for the second re-submittal, etc. A re-submittal affecting transmittal XX XX XX-1 would then be numbered XX XX XX-1A. The number XX XX XX-1 would then be entered in the space "Previous Transmittal Number," which is left blank except on re-submittals. Re-submittals shall include all previous submittal information. No partial submittals will be accepted.

## 1.5 SPECIFIC CATEGORY REQUIREMENTS

### A. General

1. Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal.
  - a. Submittals shall contain:
    - 1) The date of submittal and the dates of any previous submittals.
    - 2) The project title: Noonday Creek WRF Chemical Systems Upgrade

- 3) The project number: Project No. T1023
- 4) The names of the:
  - a) Contractor
  - b) Supplier
  - c) Manufacturer
- 5) Identification of the product, with the Specification Section number and equipment tag numbers.
- 6) Field dimensions, clearly identified as such.
- 7) Relation to adjacent or critical features of the work or materials.
- 8) Applicable standards, such as ASTM or Federal Specification numbers.
- 9) Notification to the Engineer in writing, at time of submittal, of any deviations on the submittals from requirements of the Contract Documents.
- 10) Identification of revisions on re-submittals.
- 11) Two 4 inch x 4 inch blank spaces for Contractor and Engineer stamps.
- 12) Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
- 13) Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

#### 1.6 ROUTING OF SUBMITTALS

A. Submittals and routine correspondence shall be routed as follows:

1. Supplier to Contractor (through representative if applicable) for preliminary check.
2. Contractor to Consulting Engineer for general review or comment.
3. Consulting Engineer to Contractor.
4. Contractor to Supplier.

#### 1.7 ADDRESS FOR COMMUNICATIONS

A. Engineering Strategies, Inc.  
3855 Shallowford Road, Suite 525  
Marietta, GA 30062  
(770) 429-0001

#### 1.8 REVIEW OF SUBMITTALS

A. Review Time

1. Allow 21 days from the date the submittal is received in the Engineer's office for the Engineer to review and respond to each submittal, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

B. Engineer's Action

1. "No Exception Noted" - Indicates the drawings have been reviewed for conformance with the contract documents and no exceptions have been taken. Proceed with the work.
2. "Furnish as Noted" - Indicates the drawings have been reviewed for conformance with the contract documents and work may proceed in accordance with all comments. Re-submittal will not be required.

3. "Revise and Resubmit" - Indicates the drawings have been reviewed for conformance with the contract documents, and work may not proceed. After items to which exceptions have been taken are corrected, Contractor shall again submit copies for review.
4. "Rejected" - Indicates the drawings have been reviewed for conformance with the contract documents and are too incomplete or in an unacceptable condition for review. A notation will be made on the shop drawings as to the exceptions taken. Drawings shall be revised and resubmitted for review before proceeding with the work.
5. "Submit Specific Item" - Indicates that one or more items in the submittal were missing or incomplete. Work may commence on any items to which no exceptions were taken; missing or incomplete items must be submitted as noted.

C. Re-submittals

1. Engineer will review a maximum of one re-submittal. If more than one re-submittal is required, the Contractor will be charged the Engineer's standard hourly rate to review the additional submittals.

\*\* END OF SECTION \*\*

SECTION 01 35 13  
PROJECT SAFETY

1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. The Contractor shall be responsible for conducting all work in a safe manner and shall take reasonable precautions to ensure the safety and protection of workers, property, and the general public. The Contractor's responsibility for protecting the public is described in Article 11 of the "General Conditions."
- B. All construction work shall be conducted in accordance with the latest applicable requirements of Part 1926 of the Occupational Safety and Health Act, Safety and Health Regulations for Construction, Section 107 of the Contract Work Hours and Safety Standards Act, as well as any other local or state safety codes and regulations.
- C. The Contractor shall designate a trained and qualified employee who is to be responsible for ensuring that the work is performed safely and in conformance with all applicable regulations. The name and resume of the designated safety supervisor shall be submitted to the Engineer prior to commencing any construction work.
- D. The Contractor shall determine for himself the safety hazards involved in prosecuting the work and the precautions necessary to conduct the work safely. If the Contractor is unsure as to any special hazards which may be unique to the job, it shall be his responsibility to contact the Engineer and request such information in writing prior to beginning the work.
- E. The Contractor shall bear all risks associated with performing the work and shall fully indemnify the Owner and Engineer. Reference Section 00 73 16, Insurance Requirements for Contractors.
- F. Contractor shall comply with all OSHA regulations, as well as any other local or state safety codes and regulations related to trenching and excavation, confined space entry, and fall protection.

1.2 SPECIAL REQUIREMENTS

- A. The Contractor's attention is directed to the fact that construction activities at the wastewater facility will occasionally involve work in potentially hazardous environments in which oxygen deficient, toxic, or explosive conditions may exist. Additional hazards arise from the presence of pathogens in the wastewaters and sludges found in the wastewater facility and from the slimes and scum layers that coat walking and working surfaces. In dealing with these hazards, the Contractor shall take special precautions to ensure worker safety. Such precautions shall include, but shall not be limited to, the following, as applicable:
  - 1. Installing temporary forced air ventilation equipment and ducts for fresh air in enclosed areas.
  - 2. Using pneumatic tools and equipment instead of electric-driven equipment in hazardous areas.
  - 3. Avoiding the use of cutting torches, field welding, and grinders in hazardous areas.
  - 4. Cleaning and disinfecting working surfaces with hot water high pressure washers prior to commencing work.
  - 5. Installing sealed wooden baffles or bulkheads to isolate working areas from hazardous atmospheres.
  - 6. Providing portable oxygen meters, combustible gas detectors, and hydrogen sulfide detectors to continuously monitor the atmosphere in enclosed working areas.
  - 7. Providing safety harnesses, safety lines, and recovery crews for workers in hazardous

areas.

8. Providing self-contained breathing apparatus with spare air cylinders for workers in hazardous areas.
  9. Providing dry chemical fire extinguishers and connected fire hoses in areas where a danger of fire or explosion exists.
  10. Providing adequate, oxygen-equipped, first aid facilities.
  11. Providing suitable wash-up areas and facilities for workers.
  12. Installing temporary lighting using explosion-proof fixtures in hazardous environments.
  13. Installing approved warning and hazard signs and posting safety procedures.
  14. Instructing all workers as to the hazards present, the procedures to be followed, and the proper function and use of all safety and emergency equipment furnished.
- B. Prior to commencing work on existing facilities and equipment, the Contractor shall notify the Owner and shall ensure that the source of electrical energy to all affected equipment is shut off and locked out at the appropriate motor control center. Local switches and push-button stations, where provided, shall be locked in the off position.
- C. Prior to entering or commencing work in a hazardous area, the Contractor shall ensure that all safety and emergency equipment is in place and in satisfactory operating condition.

**\*\* END OF SECTION \*\***

SECTION 01 42 19  
REFERENCE STANDARDS

1 GENERAL

1.1 DESCRIPTION

- A. Whenever reference is made to conform to the standards of any technical society, organization, body, code or standard, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for Bids. This shall include the furnishing of materials, testing of materials, fabrication and installation practices. In those cases where the Contractor's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.
- B. The inclusion of an organization under one category does not preclude that organization's standards from applying to another category.
- C. In addition, all work shall comply with the applicable requirements of local codes, utilities and other authorities having jurisdiction.
- D. All material and equipment, for which a UL Standard, an AGA or NSF approval or an ASME requirement is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.
- E. The standards which apply to this Project are not necessarily restricted to those organizations which are listed in Article 1.2.

1.2 STANDARD ORGANIZATIONS

A. Piping and Valves:

- 1. ACPA American Concrete Pipe Association
- 2. ANSI American National Standards Institute
- 3. API American Petroleum Institute
- 4. ASME American Society of Mechanical Engineers
- 5. AWWA American Water Works Association
- 6. CISPI Cast Iron Soil Pipe Institute
- 7. DIPRA Ductile Iron Pipe Research Association
- 8. FCI Fluid Controls Institute
- 9. MSS Manufacturers Standardization Society
- 10. NCPI National Clay Pipe Institute
- 11. NSF National Sanitation Foundation
- 12. PPI Plastic Pipe Institute
- 13. Uni-Bell PVC Pipe Association

B. Materials:

- 1. AASHTO American Association of State Highway and Transportation Officials
- 2. ALS American Lumber Standards
- 3. AMA Acoustical Materials Association
- 4. ANSI American National Standards Institute

- 5. ASTM            American Society for Testing and Materials
- C. Painting and Surface Preparation:
  - 1. NACE            National Association of Corrosion Engineers
  - 2. SSPC            The Society for Protective Coatings
- D. Electrical and Instrumentation:
  - 1. AEIC            Association of Edison Illuminating Companies
  - 2. AIEE            American Institute of Electrical Engineers
  - 3. EIA             Electronic Industries Association
  - 4. ICEA            Insulated Cable Engineers Association
  - 5. IEC             International Electrotechnical Commission
  - 6. IEEE            Institute of Electrical and Electronic Engineers
  - 7. IES             Illuminating Engineering Society
  - 8. IPC             Institute of Printed Circuits
  - 9. IPCEA          Insulated Power Cable Engineers Association
  - 10. ISA            The Instrumentation, Systems, and Automation Society
  - 11. NEC            National Electric Code
  - 12. NEMA          National Electrical Manufacturers Association
  - 13. NFPA          National Fire Protection Association
  - 14. REA            Rural Electrification Administration
  - 15. TIA            Telecommunications Industries Association
  - 16. UL             Underwriter's Laboratories
  - 17. VRCI          Variable Resistive Components Institute
- E. Aluminum:
  - 1. AA              Aluminum Association
  - 2. AAMA          American Architectural Manufacturers Association
- F. Steel, Concrete, and Asphalt:
  - 1. ACI            American Concrete Institute
  - 2. AI              Asphalt Institute
  - 3. AISC          American Institute of Steel Construction, Inc.
  - 4. AISI          American Iron and Steel Institute
  - 5. CRSI          Concrete Reinforcing Steel Institute
  - 6. NRMA         National Ready-Mix Association
  - 7. PCA            Portland Cement Association
  - 8. PCI            Prestressed Concrete Institute
- G. Welding:
  - 1. ASME          American Society of Mechanical Engineers
  - 2. AWS            American Welding Society
- H. Government and Technical Organizations:

1. AIA American Institute of Architects
  2. APHA American Public Health Association
  3. APWA American Public Works Association
  4. ASA American Standards Association
  5. ASAE American Society of Agricultural Engineers
  6. ASCE American Society of Civil Engineers
  7. ASQC American Society of Quality Control
  8. ASSE American Society of Sanitary Engineers
  9. CFR Code of Federal Regulations
  10. CSI Construction Specifications Institute
  11. EDA Economic Development Administration
  12. EPA Environmental Protection Agency
  13. FCC Federal Communications Commission
  14. FmHA Farmers Home Administration
  15. FS Federal Specifications
  16. IAI International Association of Identification
  17. ISEA Industrial Safety Equipment Association
  18. ISO International Organization for Standardization
  19. ITE Institute of Traffic Engineers
  20. NBFU National Board of Fire Underwriters
  21. NFPA National Fluid Power Association
  22. NBS National Bureau of Standards
  23. NISO National Information Standards Organization
  24. OSHA Occupational Safety and Health Administration
  25. SI Salt Institute
  26. SPI The Society of the Plastics Industry, Inc.
  27. USDC United States Department of Commerce
  28. WEF Water Environment Federation
- I. General Building Construction:
1. AHA American Hardboard Association
  2. AHAM Association of Home Appliance Manufacturers
  3. AITC American Institute of Timber Construction
  4. APA American Parquet Association, Inc.
  5. APA American Plywood Association
  6. BHMA Builders Hardware Manufacturers Association
  7. BIFMA Business and Institutional Furniture Manufacturers Association
  8. DHI Door and Hardware Institute
  9. FM Factory Mutual Fire Insurance Company

- 10. HPMA           Hardwood Plywood Manufacturers Association
  - 11. HTI            Hand Tools Institute
  - 12. IME            Institute of Makers of Explosives
  - 13. ISANTA        International Staple, Nail and Tool Association
  - 14. ISDSI         Insulated Steel Door Systems Institute
  - 15. IWS            Insect Screening Weavers Association
  - 16. MBMA         Metal Building Manufacturers Association
  - 17. NAAMM        National Association of Architectural Metal Manufacturers
  - 18. NAGDM        National Association of Garage Door Manufacturers
  - 19. NCCLS         National Committee for Clinical Laboratory Standards
  - 20. NFPA          National Fire Protection Association
  - 21. NFSA          National Fertilizer Solutions Association
  - 22. NKCA          National Kitchen Cabinet Association
  - 23. NWMA         National Woodwork Manufacturers Association
  - 24. NWWDA        National Wood Window and Door Association
  - 25. RMA           Rubber Manufacturers Association
  - 26. SBC           SBCC Standard Building Code
  - 27. SDI           Steel Door Institute
  - 28. SIA            Scaffold Industry Association
  - 29. SMA           Screen Manufacturers Association
  - 30. SPRI          Single-Ply Roofing Institute
  - 31. TCA           Tile Council of America
  - 32. UBC           Uniform Building Code
- J. Roadways:
- 1. AREA           American Railway Engineering Association
  - 2. DOT            Department of Transportation
  - 3. SSRBC         Standard Specifications for Construction of Transportation Systems,  
Georgia Department of Transportation
- K. Plumbing:
- 1. AGA            American Gas Association
  - 2. NSF            National Sanitation Foundation
  - 3. PDI            Plumbing Drainage Institute
  - 4. SPC            SBCC Standard Plumbing Code
- L. Refrigeration, Heating, and Air Conditioning:
- 1. AABC           Associated Air Balance Council
  - 2. AMCA           Air Movement and Control Association
  - 3. ARI            American Refrigeration Institute
  - 4. ASHRAE        American Society of Heating, Refrigeration, and Air Conditioning  
Engineers

5. ASME American Society of Mechanical Engineers
6. CGA Compressed Gas Association
7. CTI Cooling Tower Institute
8. HEI Heat Exchange Institute
9. IIAR International Institute of Ammonia Refrigeration
10. NB National Board of Boilers and Pressure Vessel Inspectors
11. PFMA Power Fan Manufacturers Association
12. SAE Society of Automotive Engineers
13. SMACNA Sheet Metal and Air Conditioning Contractors National Association
14. SMC SBCC Standard Mechanical Code
15. TEMA Tubular Exchangers Manufacturers Association

M. Equipment:

1. AFBMA Anti-Friction Bearing Manufacturers Association, Inc.
2. AGMA American Gear Manufacturers Association
3. ALI Automotive Lift Institute
4. CEMA Conveyor Equipment Manufacturers Association
5. CMAA Crane Manufacturers Association of America
6. DEMA Diesel Engine Manufacturers Association
7. MMA Monorail Manufacturers Association
8. OPEI Outdoor Power Equipment Institute, Inc.
9. PTI Power Tool Institute, Inc.
10. RIA Robotic Industries Association
11. SAMA Scientific Apparatus Makers Association

1.3 SYMBOLS

A. Symbols and material legends shall be as scheduled on the Drawings.

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

**\*\* END OF SECTION \*\***

SECTION 01 50 00  
TEMPORARY FACILITIES

1 GENERAL

1.1 SCOPE OF WORK

- A. Provide Contractors temporary field office (if desired).
- B. Provide temporary facilities and utilities including power, lighting, heating, potable water, and sanitary facilities.
- C. Provide temporary ferrous chloride chemical feed facilities.
- D. Provide temporary sodium hypochlorite chemical feed facilities.
- E. Provide temporary sodium bisulfate chemical feed facilities.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
  - 1. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications:
    - a. Drawings showing plan, elevation, and appropriate cross sections of the temporary facility being provided.
    - b. Complete engineering data including, but not limited to, descriptive data and material specifications, as appropriate, to support the design of the products being provided.
    - c. Provide calculations for the sizing of the chemical distribution pipe.
    - d. Provide a detailed description of how system will operate.

2 PRODUCTS

2.1 CONTRACTORS TEMPORARY FIELD OFFICE

- A. Contractor may provide a temporary field office for his use if desired. The Owners facilities are not available for the Contractors use.
- B. Contractor is responsible for providing all utility connections to the trailer.
- C. Contractor is responsible for all activities, costs, and fees for providing and removing temporary utilities and services for supporting the temporary facilities and for construction.
- D. Location of temporary field office shall be coordinated with the Owner.

2.2 TEMPORARY UTILITIES

- A. General
  - 1. Coordinate and install all temporary services in accordance with the requirements of the utility companies having jurisdiction and as required by applicable codes and regulations.
  - 2. At the completion of the work, or when the temporary services are no longer required, the facilities shall be restored to their original conditions by the Contractor.
  - 3. All costs in connection with the temporary services including, but not limited to, installation, utility company service charges, maintenance, relocation, and removal shall be paid by the Contractor at no additional cost to the Owner.
  - 4. Some temporary facilities that may be required may be indicated on the Drawings; however, the Drawings do not necessarily show any or all of the temporary facilities that the Contractor ultimately uses to complete the work.

## B. Temporary Power

1. Provide temporary power facilities required for the proper execution and inspection of the work. These facilities shall be installed and maintained by the Contractor, and shall be located in such a manner as to result in the least interference with work upon the project site. Temporary power facilities shall remain in place after completion of construction until final acceptance of the work. After final acceptance of the work, the Contractor shall remove temporary power facilities.
2. Temporary power shall be furnished complete with main disconnect, over-current protection, meter outlet, branch circuit breakers, and wiring as required; including branch circuit breakers and wiring as required for furnishing temporary power. Temporary power shall be installed in accordance with the requirements of the servicing power company and applicable standards and codes. The meter for the temporary service for construction purposes shall be registered in the name of the Contractor and all energy charges for furnishing this temporary electric power shall be paid by the Contractor.
3. The Contractor shall make all necessary arrangements, and pay for all permits, inspections, and power company charges for all temporary service installations. Upon completion of the work, but prior to acceptance by the Owner, the Contractor shall remove all temporary services.

## C. Temporary Lighting

1. Provide temporary lighting facilities for the proper execution and inspection of the work. These facilities shall be installed and maintained by the Contractor and shall be located in such a manner as to result in the least interference with work upon the project site and existing facilities.

## D. Temporary Heating

1. Provide temporary heating facilities for the proper execution of the work. These facilities shall be installed and maintained by the Contractor and shall be located in such a manner as to result in the least interference with work upon the project site and existing facilities.

## E. Temporary Water

1. The Contractor shall make the necessary arrangements for securing and transporting all water required in the construction, including water required for mixing of concrete, sprinkling, testing, flushing, flooding, jetting, sanitary facilities, field offices, or cleaning, and including any temporary pipeline or equipment which may be necessary to make use of such water.
2. Water service shall be protected from freezing and the service shall be extended and relocated as necessary to meet temporary water requirements.

## F. Potable Water

1. Provide potable drinking water for employees, subcontractors, inspectors, engineers, the Owner and other personnel associated with the project.

## G. Sanitary Facilities

1. Provide sufficient sanitary facilities in proximity to the areas of work for contractor and subcontractor employees. Contractor will be responsible for continual maintenance and servicing of these facilities.

## H. First-Aid Facilities

1. Contractor shall maintain at a well-known place at the job site, all articles necessary for giving first-aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees) who may be injured on the job site. In no case, shall employees be permitted to work at a job site before the employer has made a standing arrangement (verified in writing to the Owner) for removal of injured persons to a hospital or a doctor's care.

## 2.3 TEMPORARY FERROUS CHLORIDE SYSTEM

- A. Provide a temporary ferrous chloride system to feed ferrous chloride into the treatment process during construction.
- B. Set up temporary ferrous chloride system near the existing bulk chemical storage area.
- C. Temporary ferrous chloride system shall be a turnkey system consisting of storage tanks, chemical pumps, air compressors, generators, controls, flow meter, chemical piping, spill containment for all components, freeze protection, and all other appurtenances required for a complete and operable system. Temporary system shall be provided by Rain for Rent, Inc., or equivalent.
- D. Contractor shall be responsible for maintaining system including purchasing and supplying fuel for any fuel operated components of the system. CCWS will be responsible for ordering, delivery, and payment of chemicals.
- E. Contractor shall keep the area around the temporary chemical feed system clean at all times and shall be responsible for cleaning all spills. If any existing infrastructure (including asphalt pavement, concrete, etc.) is damaged, the damaged items shall be replaced at the Contractor's expense.
- F. All equipment provided with the temporary chemical feed system shall be compatible with the chemical.
- G. Temporary ferrous chloride system shall be connected to existing ferrous chloride storage tanks T-1360C and T-1360D while tanks T-1360A and T-1360B are replaced. After tanks T-1360A and T-1360B are replaced, temporary system shall be connected to the new tanks while tanks T-1360C and T-1360D are replaced. Provide all piping and appurtenances required to make these connections.
- H. Pumps
  1. Provide a minimum of two variable speed pumps, one duty and one standby, capable of meeting the following flow rates (If two pumps are provided, each pump must meet the maximum demand. If two pumps are provided to meet the maximum demand, a third spare pump of equal capacity must be provided):
    - a. Maximum Flow Rate: 190 GPH (3.2 GPM)
    - b. Average Flow Rate: 95 GPH (1.58 GPM)
  2. Pumps speed will be manually adjusted by treatment plant operators based on process conditions.
- I. Provide a minimum of two air compressors or generators, 1 duty and 1 standby, as required, for operating the temporary ferrous chloride chemical feed system.
- J. Provide control panel for temporary chemical feed system. Control panel shall have all controls required to operate temporary system and shall have lights and an audible horn for indicating alarms.
- K. Provide a flow meter for measuring the flow rate and the daily volume of chemical pumped. Flow rate and volume shall be continuously recorded.
- L. Provide alarms for the temporary system to monitor high level in the containment areas, pump failure, compressor failure (if applicable), generator failure (if applicable), and any other critical alarms. Provide an auto-dialer with cellular phone service to notify the contractor and/or temporary chemical feed system vendor of an alarm condition.
- M. Support chemical piping to prevent movement and provide ramps and barriers as necessary to prevent trip hazards and damage to pipe from grass cutting operations.
- N. Temporary Chemical Feed System Provisions:
  1. Contractor must perform daily inspection and maintenance of the chemical feed system.
  2. Provide installed redundancy of all equipment so that standby equipment is readily

available for immediate use.

3. Provide appropriate provisions for safe access by Owner's personnel to any control panels or other components of the system requiring periodic adjustment or inspection, including hazard-free walking surfaces, clearly marked panels and equipment, adequate lighting, etc.
4. Contractor is responsible for clean-up of any spills that occur.
5. Contractor or system supplier must immediately respond to any alarm conditions and correct any problems found.
6. Provide recording provisions for any flow meters or other instruments used so that historical information can be retained.

#### 2.4 TEMPORARY SODIUM HYPOCHLORITE SYSTEM

- A. Provide a temporary sodium hypochlorite system to feed sodium hypochlorite into the treatment process during construction.
- B. Set up temporary sodium hypochlorite system adjacent to the existing effluent filters.
- C. Temporary sodium hypochlorite system shall be a turnkey system consisting of storage tanks, chemical pumps, air compressors, generators, controls, flow meter, chemical piping, spill containment for all components, and all other appurtenances required for a complete and operable system. Temporary system shall be provided by Rain for Rent, Inc., or equivalent.
- D. Contractor shall be responsible for maintaining system including purchasing and supplying fuel for any fuel operated components of the system. CCWS will be responsible for ordering, delivery, and payment of chemical.
- E. Contractor shall keep the area around the temporary chemical feed system clean at all times and shall be responsible for cleaning all spills. If any existing infrastructure (including asphalt pavement, concrete, etc.) is damaged, the damaged items shall be replaced at the Contractor's expense.
- F. The freezing point/melting point of sodium hypochlorite ranges from -10°F to 24°F. Provide freeze protection for all wetted components, storage tank, piping, etc., of the temporary sodium hypochlorite system.
- G. All equipment provided with the temporary chemical feed system shall be compatible with the chemical.
- H. Provide one storage tank. Storage tank shall have a minimum capacity of 6,900 gallons.
- I. Pumps
  1. Provide a minimum of two variable speed pumps, one duty and one standby, capable of meeting the following flow rates:
    - a. Maximum Flow Rate: 97 GPH (1.62 GPM)
    - b. Average Flow Rate: 50 GPH (0.83 GPM)
  2. Pumps speed will be manually adjusted by treatment plant operators based on process conditions.
- J. Provide a minimum of two air compressors or generators, one duty and one standby, as required, for operating temporary chemical system.
- K. Provide control panel for temporary chemical feed system. The controls for the temporary chemical feed system shall be capable of varying the pump flow rate based on a 4-20 mA signal. Control panel shall have all controls required to operate temporary system and shall have lights and an audible horn for indicating alarms.
- L. Provide a flow meter for measuring the flow rate and the daily volume of chemical pumped. Flow rate and volume shall be continuously recorded.
- M. Provide alarms for the temporary system to monitor high level and low level in the storage

tank, high level in the containment area, pump failure, compressor failure (if applicable), generator failure (if applicable), and other critical alarms. Provide an auto-dialer with cellular phone service to notify the contractor and/or temporary chemical feed system vendor of an alarm condition.

- N. Support chemical piping to prevent movement and provide ramps and barriers as necessary to prevent trip hazards and damage to pipe from grass cutting operations.
- O. Temporary Chemical Feed System Provisions:
  - 1. Contractor must perform daily inspection and maintenance of the chemical feed system.
  - 2. Provide installed redundancy of all equipment so that standby equipment is readily available for immediate use.
  - 3. Provide appropriate provisions for safe access by Owner's personnel to any control panels or other components of the system requiring periodic adjustment or inspection, including hazard-free walking surfaces, clearly marked panels and equipment, adequate lighting, etc.
  - 4. Contractor is responsible for clean-up of any spills that occur.
  - 5. Contractor or system supplier must immediately respond to any alarm conditions and correct any problems found.
  - 6. Provide recording provisions for any flow meters or other instruments used so that historical information can be retained.

## 2.5 TEMPORARY SODIUM BISULFITE SYSTEM

- A. Provide a temporary sodium bisulfite system to feed sodium bisulfite into the treatment process during construction.
- B. Set up temporary sodium bisulfite system adjacent to the existing effluent filters.
- C. Temporary sodium bisulfite system shall be a turnkey system consisting of storage tanks, chemical pumps, air compressors, generators, controls, flow meter, chemical piping, spill containment for all components, and all other appurtenances required for a complete and operable system. Temporary system shall be provided by Rain for Rent, Inc., or equivalent.
- D. Contractor shall be responsible for maintaining system including purchasing and supplying fuel for any fuel operated components of the system. CCWS will be responsible for ordering, delivery, and payment of chemical.
- E. Contractor shall keep the area around the temporary chemical feed system clean at all times and shall be responsible for cleaning all spills. If any existing infrastructure (including asphalt pavement, concrete, etc.) is damaged, the damaged items shall be replaced at the Contractor's expense.
- F. The freezing point/melting point of sodium bisulfite is approximately 45°F. Provide freeze protection for all wetted components, storage tank, piping, etc., of the temporary sodium bisulfite system.
- G. All equipment provided with the temporary chemical feed system shall be compatible with the chemical.
- H. Provide one storage tank. Storage tank shall have a minimum capacity of 6,900 gallons.
- I. Pumps
  - 1. Provide a minimum of two variable speed pumps, one duty and one standby, capable of meeting the following flow rates:
    - a. Maximum Flow Rate: 30 GPH (0.5 GPM)
    - b. Average Flow Rate: 15 GPH (0.25 GPM)
  - 2. Pumps speed will be manually adjusted by treatment plant operators based on process

conditions.

- J. Provide a minimum of two air compressors or generators, one duty and one standby, as required, for operating temporary chemical system.
- K. Provide control panel for temporary chemical feed system. The controls for the temporary chemical feed system shall be capable of varying the pump flow rate based on a 4-20 mA signal. Control panel shall have all controls required to operate temporary system and shall have lights and an audible horn for indicating alarms.
- L. Provide a flow meter for measuring the flow rate and the daily volume of chemical pumped. Flow rate and volume shall be continuously recorded.
- M. Provide alarms for the temporary system to monitor high level and low level in the storage tank, high level in the containment area, pump failure, compressor failure (if applicable), generator failure (if applicable), and other critical alarms. Provide an auto-dialer with cellular phone service to notify the contractor and/or temporary chemical feed system vendor of an alarm condition.
- N. Support chemical piping to prevent movement and provide ramps and barriers as necessary to prevent trip hazards and damage to pipe from grass cutting operations.
- O. Temporary Chemical Feed System Provisions:
  - 1. Contractor must perform daily inspection and maintenance of the chemical feed system.
  - 2. Provide installed redundancy of all equipment so that standby equipment is readily available for immediate use.
  - 3. Provide appropriate provisions for safe access by Owner's personnel to any control panels or other components of the system requiring periodic adjustment or inspection, including hazard-free walking surfaces, clearly marked panels and equipment, adequate lighting, etc.
  - 4. Contractor is responsible for clean-up of any spills that occur.
  - 5. Contractor or system supplier must immediately respond to any alarm conditions and correct any problems found.
  - 6. Provide recording provisions for any flow meters or other instruments used so that historical information can be retained.

### 3 EXECUTION

#### 3.1 GENERAL

- A. Install all temporary facilities and operate continuously for a minimum of 48 hours without failure prior to beginning demolition activities.
- B. Monitor temporary facilities 24 hours per day and make repairs to faulty equipment immediately.
- C. Coordinate with the Owner to have chemical delivered.
- D. After construction work is complete, remove temporary facilities and restore all areas to pre-existing conditions.

\*\* END OF SECTION \*\*

SECTION 01 60 00  
GENERAL EQUIPMENT STIPULATIONS

1 GENERAL

1.1 SCOPE

- A. These General Equipment Stipulations apply, in general, to all equipment and piping as explained below.

1.2 COORDINATION

- A. The Contractor shall assume full responsibility for the coordination of the installation of all equipment, materials and products furnished under these Contract Documents. The Contractor shall be completely responsible for verification that all structures, piping and equipment components furnished by him and/or his Subcontractors and Suppliers are compatible. The Contractor shall start up each equipment system and shall make all necessary adjustments to place each system in proper operating condition.

1.3 ADAPTATION AND LOCATION OF EQUIPMENT

- A. The Contractor shall install the work in such manner that the equipment, piping, vents, conduit, panels, ductwork, etc., be as neatly installed and out-of-the-way as physically possible. All equipment, piping, ductwork, conduit, etc., shall be installed to provide needed maintenance and passage space.

1.4 PATENT ROYALTIES

- A. All royalties and fees for patents covering materials, articles, apparatus, devices, or equipment shall be included in prices bid by the Contractor.

1.5 EQUIPMENT GUARANTEE

- A. The Contractor and equipment manufacturer shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective materials, breakage or other failure. Manufacturers of equipment included in these specifications shall warrant the units being supplied to the Owner against defects in workmanship and material under normal use, operation and service for a period of 1 year from the date of substantial completion of the work by the Owner unless an extended warranty is otherwise specified under individual equipment sections.
- B. The Contractor shall furnish and replace, without cost to the Owner, all equipment parts that are defective or show undue wear within the warranty period.
- C. The Warranty shall be in a printed form and apply to all components of the unit supplied by the Manufacturer.

1.6 WORKMANSHIP AND MATERIALS

- A. All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall be new and shall not have been in service at any time prior to delivery, except as required by tests. All bolts, nuts, fastenings, pipe and fittings shall be manufactured in conformance with the United States system of measurement.
- B. Materials shall be suitable for service conditions. Iron castings shall be tough, close grained, gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to ASTM A 48, Class 30 minimum. Plugging of defective castings shall not be permitted. Castings shall be annealed to remove internal stresses prior to machining and shall have the mark number and heat number cast on them.
- C. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory

loads.

- D. All replaceable or expendable elements such as filters, screens, drive belts, fuses, indicator lamps, etc., shall be easily accessible and replaceable without need of dismantling equipment or piping. All such items shall be of a standard type that is readily available from multiple suppliers.
- E. Threaded openings for drains or vents in pump volutes, compressor or fan scrolls, air receivers, and heat exchangers which are plugged during normal operation shall be provided with stainless steel plugs.

#### 1.7 LUBRICATION AND LUBRICATION FITTINGS

- A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during start up or shutdown and shall not waste lubricants.
- B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity by the Contractor to fill all lubricant reservoirs and to replace all lubricants consumed during testing, start up, and initial operation. The Contractor shall provide sufficient quantities of lubricants to lubricate all equipment for one year of normal service before final acceptance of the equipment will be made by the Owner.
- C. Where special run-in oil or storage lubricants are used, they shall be flushed out and replaced with the required service lubricant by the Contractor.
- D. Tag each piece of equipment with cloth tag showing proper type lubricant, period between lubrications, date of lubrication, and worker's initials. Have space for ten lubrication notations.
- E. Except for rotating shaft couplings, all lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards. Fittings shall be accessible from safe, permanent platforms or walk areas. Fittings shall be of the bull-neck, check type for use with a portable high pressure grease gun. Connection from a remote fitting to the point of use shall be with minimum 3/16-inch stainless steel tubing, securely mounted parallel to equipment lines and protected where exposed to damage.

#### 1.8 ELECTRIC MOTORS

- A. Unless otherwise required by the detailed equipment specifications, motors furnished with equipment shall comply with the following:
  - 1. Motors shall be designed and applied in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment.
  - 2. Where frequent starting occurs, motors shall be designed for frequent starting duty equivalent to the duty service required by the driven equipment.
  - 3. All motors shall be rated for continuous duty at 40°C ambient. Motor temperature rise above 40°C ambient on continuous operation at nameplate horsepower shall not exceed the NEMA limit for 1.0 service factor and Class B insulation, or Class A insulation if used.
  - 4. Motors shall be designed for full voltage starting. Motors shall operate under a  $\pm 10$  percent voltage variation and  $\pm 5$  percent frequency variation.
  - 5. Motor-bearing life shall be based upon the actual operating load conditions imposed by the driven equipment.
  - 6. Motors shall be sized for the altitude at the location where the equipment is to be installed.
  - 7. Motors shall be sized so that, under maximum continuous load imposed by the driven equipment, the motor nameplate horsepower for continuous operation in 40°C ambient is at least 15 percent more than the driven load. Continuous equipment load shall not exceed 87 percent of motor nameplate horsepower, whether motor service factor is 1.0 or higher.

8. Where the detailed specifications call for encapsulated motor windings, the motor shall have a sealed insulation system designed for a more severe environment than usual varnish treatments can withstand. The insulation system shall be General Electric "Polyseal", Allis-Chalmers "Poxeal", U. S. Motors "Everseal", or equal. Motors in this case may be single voltage rated.
  9. Motors shall have a clamp-type grounding terminal inside the motor conduit box.
  10. Motors with external conduit boxes shall have oversized conduit boxes.
  11. Motors in occupied areas shall be quiet rated and so marked.
- B. It is the intent of this general specification to allow the manufacturer's standard motor on integrally-constructed, motor-driven equipment such as appliances, hand tools, etc., that is specified by model number in which a redesign of the complete unit would be required for a motor with other features as may be specified herein.
- C. Unless otherwise required by the detailed equipment specifications, motors within the horsepower ranges indicated below shall be rated and constructed as follows:
1. Below 3/4 horsepower:
    - a. 115-volt, 60-hertz, single phase
    - b. Totally enclosed, fan-cooled
    - c. Permanently lubricated, sealed bearings
    - d. Built-in manual-reset thermal protector; or furnished with integrally mounted stainless steel enclosed manual motor-overload switch
  2. 3/4 to 1 horsepower:
    - a. 230/460-volt, 60-hertz, 3-phase
    - b. Totally enclosed, fan cooled
    - c. Specially insulated for use in damp locations below 20°C
    - d. Grease-lubricated, antifriction bearings.
  3. 1½ horsepower and above:
    - a. 230/460-volt, 60-hertz, 3-phase
    - b. Totally enclosed, fan-cooled
    - c. Specially insulated for use in damp locations below 20°C
    - d. Grease-lubricated antifriction bearings or oil-lubricated sleeve bearings
    - e. Vertical motors shall have 15-year average-life thrust bearings.
- D. Any motor, installed in a wet-well, in an area which is physically connected to a wet-well, or in an area that is classified Class 1, Division 1 shall be explosion proof.
- E. Any motor installed in a classified area shall be designed to operate in the specific classified environment.

#### 1.9 DRIVE UNITS

- A. Except when specified otherwise in the detailed equipment specifications, 87 percent of the nameplate horsepower rating of each drive motor shall be at least equal to the theoretical brake horsepower required to drive the equipment under full load, including all losses in speed reducers and power transmission.
- B. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor.
- C. Drive units shall be designed for 24-hour continuous service and shall be constructed so that oil leakage around shafts is precluded.
- D. Gear Motors

1. Gear motors shall be rated AGMA Class II and shall bear an AGMA nameplate.
- E. Gear Reducers
1. Each gear reducer shall be totally enclosed, oil lubricated, with antifriction bearings throughout. Worm gear reducers shall have a service factor of at least 1.25. Shaft-mounted gear reducers shall be rated AGMA Class II. Other helical, spiral bevel, and combination bevel-helical gear reducers shall have a service factor of at least 1.40. Each gear reducer shall bear an AGMA nameplate or the manufacturer shall certify that the gear reducer is designed and rated in accordance with AGMA standards.
- F. Chain Drives
1. Chain drives shall utilize roller chain having an ultimate strength of not less than 10 times the maximum working load.
- G. V-Belt Drives
1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. Fixed ratio V-belt drives shall have a service factor of at least 1.5 based on motor nameplate horsepower.
- H. Couplings
1. Couplings between motors and drives or between drives and the driven equipment shall have a service factor of not less than 1.25 based on motor nameplate horsepower. Couplings between drives and the driven equipment shall have a service factor not less than that of the drive based on motor nameplate horsepower. All couplings rotating at speeds less than 900 rpm shall be of all steel construction. In general, couplings shall be of the tapered grid steel spring type or the crowned gear type.
- I. Overtorque Protection
1. All low speed, high torque drives for equipment such as mechanical screens, conveyors, and clarifier and thickener mechanisms shall be protected against excessive torque by means of a suitable overtorque protection device. Acceptable devices shall include torque switches, shear pins, shear keys, and full-release torque couplings. Torque limiting couplings using sliding surfaces or friction to limit torque shall not be used.

#### 1.10 SAFETY GUARDS

- A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gauge or heavier galvanized or aluminum-clad sheet steel or ½-inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water. All safety guards shall comply with OSHA General Industry Standards, Part 1910, Subpart O, Machinery and Machine Guarding. Provide tachometer access on shaft ends.

#### 1.11 ANCHOR BOLTS

- A. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Two nuts and two washers shall be furnished for each bolt. Anchor bolts to be embedded in concrete shall be provided with sufficient threads to permit a nut and washer to be installed on the concrete side of the concrete form or supporting template, but in no case shall bolts be threaded less than 2 inches. Anchor bolts used in anchoring rotating or vibrating equipment shall be provided with suitable lock washers.
- B. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit a minimum of one inch of grout beneath the

baseplate and to provide adequate anchorage into structural concrete. Individual, embedded anchor bolts for heavy equipment shall be centered in a steel pipe sleeve having an inside diameter approximately two times the bolt diameter and an embedded length approximately 8 times the bolt diameter.

- C. Bolts specified to be bent shall be bent cold. Bend radius shall not be less than twice the bolt diameter. Unless otherwise shown or specified, anchor bolts shall be embedded in concrete a minimum distance of 15 times the bolt diameter. Unless otherwise shown or specified, all anchor bolts shall be at least ½- inch in diameter.
- D. All embedded anchor bolts or anchor bolt materials shall be ASTM A 276, Type 316 stainless steel threaded per ANSI B1.1. Nuts shall be heavy hex nuts, ANSI B18.2, semifinished pattern, and shall be ASTM A194 Grade 316 stainless steel. Flat washers shall be Type 316 stainless steel.
- E. Expansion anchors shall be used to anchor equipment to existing concrete. Expansion anchors shall be stainless steel, Type 316 and shall be of the wedge type for use in bottomless holes, unless otherwise specified. Expansion anchors shall conform to the applicable requirements of Federal Specification FF-S-325. Installation methods shall be in conformance with the manufacturer's recommendations for maximum pullout and shear strength, but in no case shall the depth of the hole be less than 8 bolt diameters or 3 inches, whichever is greater. The minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall not be less than 5 times the diameter of the hole in which it is installed. The minimum distance between adjacent anchors shall not be less than 10 times the diameter of the hole in which it is installed.

#### 1.12 EQUIPMENT BASES

- A. All equipment shall be installed on a raised reinforced concrete base. The base shall be a minimum of 4 inches in height and shall extend a minimum of 2 inches beyond the equipment baseplate on all sides.
- B. The electrical contractor shall be instructed concerning electrical conduit locations prior to pouring the concrete base.
- C. Unless otherwise specified, a cast iron or welded steel baseplate shall be provided for each pump, compressor, and any other item of equipment which is to be installed on a concrete base. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a raised lip all around and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with epoxy or non-shrink grout as specified in the grouting section.
- D. On direct coupled equipment, motor and driven equipment shall be doweled to a common base with a minimum of two dowels each.

#### 1.13 ALIGNMENT OF MOTORS AND EQUIPMENT

- A. In every case where a drive motor is connected to a driven piece of equipment by a flexible coupling, the coupling halves shall be disconnected and the alignment between the motor and the equipment checked and corrected. Machinery shall first be properly aligned and leveled by means of steel wedges and shims or jacking screws near anchor bolts. Anchor bolts shall be tightened against the shims, wedges, or jacking screws and the equipment shall again be checked for level and alignment before placing grout. Wedges shall not be placed between machined surfaces.
- B. In general, checking and correcting the alignment shall follow the procedures set up in the Standards of the Hydraulic Institute, Instructions for Installation, Operation, and Maintenance of Centrifugal Pumps. Equipment shall be properly leveled and brought into angular and parallel alignment.
- C. Equipment shall be installed in such a way that no strain is transmitted to the equipment by piping systems or adjacent equipment.

#### 1.14 GROUTING

- A. A special epoxy, non-shrink grout shall be used in the placement of all pump, motor, and equipment baseplates or bedplates, column baseplates, other miscellaneous baseplates, and other grouting applications as shown on the Drawings. Grouting materials and installation shall be as specified in the section titled "Nonmetallic Grouting" of these Specifications and Contract Documents.

#### 1.15 WELDING AND BRAZING

- A. All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous and where exposed to view shall be ground smooth. All continuous welds shall be gas and liquid-tight. Welds in piping shall have full penetration and shall be smooth on the inside of the pipe. Intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart.
- B. All welding of steel and aluminum, including materials, welding techniques, general safety practices, appearance and quality of welds, and methods of correcting defective work, shall conform to the latest requirements of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Welding Code shall also apply to welded aluminum structures. The welding process and welding operators shall meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding, and Section 328, Brazing and Soldering. All welding qualification tests shall be witnessed by the Engineer, except as provided herein. All costs associated with the qualification or testing of welders and welding operators shall be borne by the Contractor.
- C. Actual welding procedures to be used in field assembly and installation of equipment furnished under this Contract shall be submitted to the Engineer for approval prior to beginning the work. Reports certifying that the welding procedures, welders, and welding operators that the Contractor intends to use are qualified as specified above shall also be submitted to the Engineer prior to beginning the work. In the case of welder qualifications for shop welding and for carbon steel field welding, welders presenting certified qualification papers validated within the preceding 6-month period and acceptable to the Engineer will not be required to take the qualification tests. In the case of field welding of stainless steel or aluminum, all welders shall be required to take the qualification tests regardless of past experience or availability of certified qualification papers.
- D. Field welding practices shall conform to OSHA construction standards, Part 1926, Subpart J, Welding and Cutting. Shop welding practices shall conform to OSHA General Industry Standards, Part 1910, Subpart Q, Welding, Cutting, and Brazing.
- E. Welding electrodes for structural steel shall conform to the standard recommendations of the AISC. Welding electrodes for stainless steel shall conform to applicable AWS Specifications and shall be as recommended by "Welded Austenitic Chromium-Nickel Stainless Steels, Techniques and Properties", published by the International Nickel Company, New York, New York. Welding electrodes for aluminum shall conform to applicable AWS Specifications.
- F. Each welder and welding operator must identify his welds with his assigned symbol.
- G. Welders performing unsatisfactory work shall be removed from the welding process.
- H. The Owner may inspect any weld by radiographic or other means. Welds not in accordance with the requirements specified herein shall be repaired or replaced at the Contractor's expense. Excessive porosity, nonmetallic inclusions, lack of fusion, incomplete penetration, and cracking shall constitute grounds for rejection of welds.

#### 1.16 ERECTION AND SETTING

- A. In the erection and setting of all fabricated equipment, the Contractor shall exercise care to ensure that each item of equipment is adequately supported so as not to bend or distort

under its own weight until adequate foundation support and anchorage are provided. Where lifting lugs, angles or clips are provided on equipment, they shall be used in erecting and setting the equipment. Erection and setting of equipment and structural steel shall conform to the requirements of OSHA Construction Standards, Part 1926, Subpart R, Steel Erection, Subpart H, Material Handling, Storage, Use, and Disposal, and Subpart N, Cranes, Derricks, Hoists, and Conveyors. Erection of structural steel shall conform to the latest requirements of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

- B. During placement and prior to any grouting or connection of adjacent piping the equipment shall be leveled and aligned true to level, plumb, alignment, and grade with all parts bearing or fitting the structure or equipment accurately and securely. It shall not be permitted to cock out of alignment, redrill, reshape, or force fit any fabricated items.
- C. The Contractor shall take all measurements necessary to properly fit his work in the field, and he shall be governed by and responsible for these measurements and the proper working out of all details. The Contractor shall be responsible for the correct fitting of all work in the field and the accurate placement of all anchor bolts installed by him.
- D. The Contractor shall bring all parts to be erected or assembled into close contact. Before assembly, all surfaces to be in contact with each other shall be thoroughly cleaned. Drift pins may be used only for bringing members into position, never to enlarge or distort holes. Torching or burning of holes or cutting of fabricated items to correct misalignment or shop errors shall not be permitted. Enlargement of holes necessary to make field connections shall be done only with the Engineer's approval by reaming with twist drills and in a manner acceptable to the Engineer.
- E. All equipment shall be furnished with suitable eyebolt lifting lugs or lifting angles to facilitate handling.

#### 1.17 SPECIAL TOOLS AND ACCESSORIES

- A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Special tools and accessories shall include those tools and accessories not normally available in an industrial hardware or mill supply house. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

#### 1.18 SHOP PRIMING AND PAINTING

- A. All equipment shop priming and painting, including surface preparation, workmanship and materials, shall be as specified in the section titled "Painting", of these Specifications.

#### 1.19 FIELD PRIMING

- A. All iron and carbon steel surfaces not specified to be galvanized or shop primed and all ferrous or nonferrous surfaces specified to be field primed and painted shall be coated in the field with one or more coats of primer in accordance with the requirements of the section titled "Painting", of these Specifications.

#### 1.20 FIELD PAINTING

- A. Except for interior surfaces of vessels and enclosed equipment not specified to be field painted, all ferrous and nonferrous surfaces of equipment which have received one or more coats of shop or field applied primer shall be field painted after installation in accordance with the requirements of the section titled "Painting", of these Specifications.

#### 1.21 GALVANIZING

- A. All galvanizing shall be done by the hot-dip process after fabrication in conformity with requirements of ASTM A123, A153, A384, and A385. Articles to be galvanized shall be pickled before galvanizing.
- B. Where galvanized bolts are specified or required by the Drawings, cadmium or zinc plated bolts will be acceptable provided cadmium plating conforms to ASTM A165, Type NS, and zinc plating conforms to ASTM A164, Type GS.

- C. Areas of galvanizing damaged by welding or burning or otherwise damaged shall be thoroughly stripped and cleared and recoated with zinc to the required thickness by the hot dip process.
- D. Galvanized articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections, and other defects not consistent with acceptable galvanizing practice.
- E. Zinc and cadmium plating shall be subject to visual examination to determine uniformity of coating. The Engineer may require that the coating uniformity be tested in accordance with ASTM A 239.

## 1.22 PROTECTION AND STORAGE

- A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times. Compressors, blowers, pumps, motors, valves, control panels, instrumentation, electrical equipment, and other equipment having antifriction or sleeve bearings shall be stored in weathertight warehouses which are maintained at a temperature of at least 60°F. Other equipment may be stored outside under cover. All equipment shall be stored above ground level and adequately supported on wood blocking or other approved support material. Printed storage instructions of the manufacturers shall be strictly adhered to.
- B. Painted, anodized, or otherwise coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. All coated surfaces which are damaged prior to acceptance of equipment shall be cleaned and coated to the satisfaction of the Engineer with the same or equivalent coating used in the original application.
- C. Electrical equipment, motors, controls, and insulation shall be protected against moisture or water damage. All space heaters provided in the equipment shall be kept connected and operating at all times until equipment is placed in service. Electrical equipment stored without space heaters shall be provided with desiccants to protect against moisture damage. Desiccant shall be silica gel in porous bags at not less than one ounce per cubic foot of volume. Desiccant shall be replaced periodically.
- D. Electrical equipment and instrumentation shall be stored in a location that is free from excessive or injurious amounts of vibration.
- E. Rotating equipment such as pumps, motors, fans, and compressors shall be rotated periodically. In the absence of specific exercising instructions by the equipment manufacturer, each item of rotating equipment shall be rotated a minimum of 10 revolutions at intervals not to exceed 20 days. When shafts are too difficult to rotate by hand, nonmetallic grips shall be used to turn the shafts.
- F. Vehicles such as trucks, forklifts, tractors, lawn mowers, and other engine-powered equipment shall be started up and operated at intervals not to exceed 15 days. Equipment shall be run until engine temperatures and pressures are in normal operating ranges. All lifting, lowering, tilting, loading, and unloading accessories shall be operated at least once during the exercise period. Equipment shall be moved under power from the parked position and run a sufficient distance so as to ensure proper lubrication of drive train and suspension components. All operators employed to exercise the vehicles shall be qualified and thoroughly familiar with the proper operation of the equipment. Forklifts, tractors, lawn mowers, and other small engine-powered equipment shall be stored indoors in garages or other suitable structures. Trucks stored outdoors shall be washed using approved materials at intervals not to exceed 15 days. All exercising and storage of vehicular equipment shall be conducted in a manner acceptable to the Engineer.
- G. Interiors of gear and bearing cases housing oil-lubricated gears and bearings shall be filled with a rust inhibiting oil prior to storage or, if extended storage is anticipated, coated periodically with a rust inhibiting oil mist at intervals of time acceptable to the Engineer. Interiors of large pumps and compressors shall be protected using vapor phase inhibitor paper or porous bags of rust inhibiting, vapor emitting crystals. Exposed shafts shall be coated with rust preventative compound then wrapped with oil-impregnated paper and polyethylene film and sealed with waterproof tape prior to shipment.

- H. Individually packaged, unpainted steel parts shall be protected by a wrapping of vapor phase inhibiting or oil-impregnated paper and polyethylene film prior to shipment.
- I. Parts and equipment not requiring periodic inspection or maintenance shall be stored unopened in their original packaging until used.
- J. Parts, instruments, controls, and small items of equipment shall be stored above ground or floor level on suitable shelves or racks in a heated, watertight warehouse.
- K. Flanged openings on equipment shall be covered with suitable solid wooden or metal blanks securely bolted to the flange using a minimum of four bolts and a suitable rubber gasket. Ends of threaded pipe and fittings shall be sealed watertight with metal or plastic caps. Threaded openings shall be sealed watertight with metal or plastic plugs. Other openings shall be sealed with two layers of 6-mil polyethylene securely taped in place with waterproof tape.
- L. All mechanical and electrical equipment in storage or installed shall be maintained by the Contractor until final acceptance by the Owner. A maintenance log on each item of equipment shall be maintained by the Contractor. Oil and grease changes, exercising, desiccant replacement, nitrogen purge checks, heater checks, insulation checks, and other periodic maintenance shall be entered in the log. The maintenance log shall be made available to the Engineer on request.
- M. A resistance test shall be performed on all motor windings and heater elements following storage and prior to installation as a check for insulation deterioration or moisture damage during storage. Insulation tests shall be performed in accordance with manufacturer instructions.
- N. Immediately prior to installation, equipment shall be cleaned of any protective coatings used during storage and any rust, dirt, grit, or other foreign material shall be removed.
- O. After installation and prior to start-up, all grease-lubricated joints, shaft couplings, and bearings shall be flushed out and re-greased. All oil reservoirs and sumps shall be completely drained and flushed and refilled with the proper lubricant. Screens and filters shall be checked for contamination and replaced if necessary. The equipment shall then be tagged, signed, and dated, indicating that the equipment has been properly lubricated for start-up.
- P. After storage, rubber parts such as valve seats, diaphragms, expansion joints, gaskets, hoses, and shaft couplings shall be checked for hardening or cracking. Deteriorated parts shall be replaced prior to start-up by the Contractor at his own expense.

#### 1.23 VIBRATION TESTING

- A. Unless specified otherwise in the detailed equipment specifications, each pump, blower, compressor, motor, or similar item of stationary rotating equipment having a rated power in excess of 50 hp or an operating speed in excess of 1,800 rpm shall be tested in the field for acceptable vibration levels. Vibration testing shall be performed by an experienced, factory-trained and authorized vibration analysis expert (not a sales representative) retained by the Contractor for this work. Each unit or pump system shall be tested separately without duplicate equipment running. All field testing shall be done in the presence of the Engineer. The Engineer shall be furnished with four (4) certified copies of vibration test data for each test performed.

#### 1.24 PRESSURE AND TEMPERATURE GAUGES

- A. The Contractor shall furnish a compound liquid-filled pressure/vacuum gauge on the suction and a liquid-filled pressure gauge on the discharge of each pump, compressor, and blower. Gauges shall be 4 to 5 inches in diameter with phenolic cases and clear shatter-proof lenses. Gauges shall have a white background and black pointers and characters. Maximum scale reading shall be approximately twice the maximum operating pressure of the fluid being measured. Accuracy shall be  $\pm 2$  percent. The operating mechanism shall be of the Bourdon type with positive protection against any solids contamination of the operating mechanism provided. Pressure gauges shall be provided with NPT connections and shall be isolated from the liquid inside the piping with isolating diaphragm seals and

gauge cocks. Pressure gauges on rotary or reciprocating equipment shall be provided with pressure snubbers.

- B. Unless otherwise specified, the Contractor shall furnish a bi-metallic temperature gauge on the discharge of each air compressor or blower. Temperature gauges shall be approximately 5 inches in diameter with stainless steel case and white background and black pointers and characters. All temperature gauges shall have a range of 0-250°F unless otherwise required for process conditions. Accuracy shall be  $\pm 1$  percent. Temperature gauges shall be furnished with stainless steel thermowells and NPT connections.
- C. Pressure gauges for steam service shall have stainless steel case and shall be equipped with pigtail siphon.

#### 1.25 LIMIT SWITCHES AND SENSORS

- A. Unless otherwise specified, limit switches on equipment shall be of the heavy-duty, precision type with NEMA 4 steel enclosure and standard pretravel lever or plunger operator as required. Limit switches shall have SPDT or DPDT contacts rated not less than 5 amps inductive, 10 amps resistance at 120 volts AC. Limit switches in hazardous locations shall be enclosed in a cast aluminum, explosion-proof enclosure.
- B. Unless otherwise specified, pressure switches shall be of the snap-acting type with internal adjustment and shock-resistant, cast, waterproof enclosure. Contacts shall be SPDT or DPDT rated minimum 15 amps at 125 volts AC. Switch operation shall be by means of a teflon diaphragm or a Type 316 stainless steel bellows, depending on pressure range. All wetted parts shall be of brass or stainless steel. Switch shall have a repeatability of  $\pm 1$  percent of range or better. Switch shall be UL listed.
- C. Unless otherwise specified, temperature switches shall be of the non-indicating, snap-acting type with internal adjustment, oil-filled stainless steel sensing bulb, and shock resistant, cast watertight enclosure. Contacts shall be SPDT or DPDT rated minimum 15 amps at 125 volts AC. Switch shall be furnished with a separable stainless steel well. Switch shall be UL listed.

#### 1.26 INSTALLATION CHECK

- A. An experienced, competent, and authorized service representative of the manufacturer of each item of equipment or other person acceptable to the Engineer shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment manufacturer's representative or other person authorized by the Engineer to perform the installation check shall be present when the equipment is placed in operation and shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.
- B. Each equipment manufacturer's representative or other person authorized by the Engineer to perform the installation check shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and (4) has been operated under full load conditions and that it operated satisfactorily. The work described under these Contract Documents will not be accepted as complete until satisfactory installation certifications have been submitted in accordance with the requirements of this section.
- C. The Contractor shall properly coordinate the visits by the manufacturer's representatives, particularly where the operation of an item of equipment is dependent on the operation of other equipment. Prior to calling the manufacturer's representative, the Contractor shall ensure that all necessary related equipment, structures, piping, and electrical work is complete. The Contractor shall pay for any revisits to the site by the manufacturer's representative made necessary due to the Contractor's failure to properly coordinate the visits.
- D. The Contractor shall inform the Engineer of any impending visits of manufacturer's representatives at least 72 hours before the visits so that the Engineer can make

arrangements to have his representative at the site to witness the installation check of the manufacturer's representative.

- E. The Contractor shall secure the services of the manufacturer's representative at the site of the work for as long as is necessary to check the installation and place the equipment in satisfactory operation.
- F. Electrical connections to equipment shall be made only upon approval of the manufacturer's representative.
- G. All costs for this work shall be included in the Contract Prices(s) and no separate payment will be made.

#### 1.27 FIELD TESTING

- A. After installation and checkout, all equipment shall be field tested. During the field tests, the equipment shall be subjected to various full load and partial load conditions and emergency operating and shutdown conditions. The ability of the equipment to operate in the prescribed manner without overheating, jamming, excessive noise or vibration, or evidence of excessive wear shall be demonstrated to the satisfaction of the Engineer.
- B. All equipment shall be tested before it is covered or insulated. All accessory equipment which may be damaged by conditions during the test shall be isolated or otherwise protected.
- C. Should results of the tests indicate that the equipment has failed to perform in accordance with requirements of the applicable detailed equipment specification, in the opinion of the Engineer, the Contractor shall make at his own expense such modifications or adjustments as required for satisfactory operation, including replacement of any or all components, if necessary. Following the modifications or adjustments, the Contractor shall repeat the field tests as specified herein. This procedure shall be repeated until results of the field tests indicate that the equipment has satisfied the requirements of the applicable specification section.
- D. The cost of all field testing shall be included in the Contract Price(s) and no separate payment will be made.

#### 1.28 IDENTIFICATION OF PIPING AND EQUIPMENT

- A. All piping and equipment shall be identified as follows:
  - 1. All equipment and piping specified to be painted shall be color coded. The colors shall be as specified in the section titled "Painting" of these Specifications. Insulated piping shall be identified using plastic bands, arrows, and letters, colored and sized in accordance with said "Painting" section.
  - 2. All major items of equipment shall have an identification nameplate. The Contractor shall submit a suitable list of all items of major equipment to the Engineer, who will furnish the Contractor with an identification numbering system. The nameplates shall be of Type 304 stainless steel, No. 6 finish, and not less than No. 16 gauge with indented stamped lettering. Nameplates shall be attached to equipment bases in easily visible and accessible locations. Nameplates shall be fastened in a permanent manner, arranged not to damage the equipment, with not less than four stainless steel fasteners. All nameplates shall contain as a minimum the following information, where applicable:
    - a. Name of equipment (from equipment specifications)
    - b. Manufacturer
    - c. Model designation
    - d. Rated horsepower
    - e. Service factor
    - f. Electrical and insulation specifications
    - g. Speed (rpm)

- h. Capacity and head (discharge pressure)
- i. Net weight
  - 1) Lettering shall be upper case, block style in size and spacing to suit the nameplate. A sample nameplate including fastenings shall be submitted to the Engineer for approval prior to manufacture of any of the nameplates. The identification nameplates shall not be painted.
- 3. All valves shall be identified with a round brass disc, approximately 1½ inches in diameter and not less than No. 14 gauge, coated with a clear lacquer. Discs shall be fastened to valves in a permanent manner; however, attachment by chain to handwheels or other operators shall not be acceptable. Discs shall be stamped using indented numerals and/or letters with a valve number corresponding to its identification number in the valve schedule to be included in the Operation and Maintenance Manual.
- 4. All pushbutton stations, switches, motor controllers, transmitters, and other control equipment shall have identification nameplates of the engraved, laminated plastic type affixed to or adjacent to the switch, pushbutton station, etc.
- 5. All manufacturer's nameplates, identification nameplates, and ASME code plates located on areas of equipment to be insulated shall be removed and reattached on uninsulated areas in a manner acceptable to the Engineer and in his presence.

#### 1.29 WARNING SIGNS

- A. Permanent warning signs shall be furnished and installed on all mechanical and electrical equipment where a hazard exists as specified herein. Signs shall be made in accordance with OSHA requirements and shall be suitable for exterior use. Mounting details shall be in accordance with manufacturer's recommendations; location as approved by the Engineer. Fasteners shall be stainless steel.
- B. Warning signs shall be approximately 10 inches high by 14 inches wide, colored yellow and black, on minimum 0.080-inch aluminum stock.

\*\* END OF SECTION \*\*

SECTION 01 65 00  
PRODUCT DELIVERY REQUIREMENTS

1 GENERAL

1.1 SUMMARY

- A. The Contractor shall provide transportation of all equipment, materials, and products furnished under these Contract Documents to the site of the work. In addition, the Contractor shall provide preparation for shipment and storage, unloading, handling and re-handling, short-term storage, extended storage, storage facilities, maintenance and protection during storage, preparation for installation, and all other work and incidental items necessary or convenient to the Contractor for the satisfactory execution and completion of the work.
- B. Any and all materials and products, including spare parts, damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.

1.2 TRANSPORTATION

- A. All equipment shall be suitably boxed, crated, or otherwise protected during transportation.
- B. All equipment shall be shipped and delivered in the largest assembled sections practical or permitted by carrier regulations to minimize the number of field connections.
- C. The Contractor shall be responsible for ensuring that the equipment is assembled and transported in such a manner so as to clear buildings, power lines, bridges, and similar structures encountered during shipment or delivery to the site of the work.
- D. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.
- E. Small items and appurtenances such as gauges, valves, switches, instruments, and probes which could be damaged during shipment shall be removed from the equipment prior to shipment and packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.
- F. Temporary shipping braces and supports shall be painted orange or yellow for easy identification.

1.3 HANDLING

- A. All equipment, materials, and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation. All equipment, materials, and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.
- B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.
- C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.
- D. Items such as nonmetallic pipe, nonmetallic conduit, flagpoles, and lighting poles shall be handled using nonmetallic slings or straps. Slings and Chains shall be padded as required to prevent damage to protective coatings and finishes.
- E. All handling, moving, lifting, transporting, and storing of materials including spare parts and other products shall be done in strict accordance with the methods recommended by the

respective manufacturers.

**\*\* END OF SECTION \*\***

SECTION 01 66 00  
PRODUCT STORAGE AND HANDLING REQUIREMENTS

1 GENERAL

1.1 GENERAL

- A. Equipment and materials shall be received, inspected, unloaded, handled, stored, maintained, and protected by the Contractor in a suitable location on or off site, if necessary, until such time as installation is required.
- B. Equipment and materials shall be stored and handled in accordance with manufacturer's requirements.

1.2 STORAGE

- A. The Contractor shall be responsible for providing satisfactory storage facilities which are acceptable to the Engineer. In the event that satisfactory facilities cannot be provided on site, satisfactory warehouse, acceptable to the Engineer, will be provided by the Contractor for such time until the equipment, materials, and products can be accommodated at the site.
- B. Equipment, materials, and products which are stored in a satisfactory warehouse acceptable to the Engineer will be eligible for progress payments as though they had been delivered to the job site.
- C. The Contractor shall be responsible for the maintenance and protection of all equipment, materials, and products placed in storage and shall bear all costs of storage, preparation for transportation, transportation, re-handling, and preparation for installation.
- D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel, and sheet construction products shall be stored with one end elevated to facilitate drainage.
- E. Unless otherwise permitted in writing by the Engineer, building products and materials such as cement, grout, plaster, gypsum board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block, and structural tile may be stored outdoors under a properly secured waterproof covering.
- F. All electrical equipment shall be stored indoors.
- G. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

1.3 EXTENDED STORAGE

- A. In the event that certain items of major equipment, such as pumps, have to be stored for an extended period of time, greater than 30 days, the Contractor shall provide satisfactory long-term storage facilities which are acceptable to the Engineer. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, lubricants, and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage. Extended storage shall be defined as any item that is placed on the stored materials list for monthly pay requests.
- B. Contractor shall submit to Engineer, manufacturer's recommended storage procedures for each piece of equipment placed in extended storage.

\*\* END OF SECTION \*\*

SECTION 01 75 16  
TESTING AND STARTUP

1 GENERAL

1.1 SCOPE

- A. Provide all labor, including the services of equipment manufacturer's representatives, and material required to perform pre-operational checkout, functional testing, and commissioning of all equipment and mechanical systems installed under this contract.
- B. The physical inspection and testing requirements in this Section are in addition to those requirements defined in the technical specifications.

1.2 DESCRIPTION

- A. The exact sequence of the facility start-up will depend upon a start-up schedule proposed by the Contractor and reviewed by the Engineer. The facility start-up schedule will be based upon the schedule information generated via the Project Schedule and a priority list of the equipment and systems developed by the Engineer, which are critical and required for startup. The start-up schedule will be updated on a monthly basis, or as directed by the Engineer.
- B. It is the Contractor's responsibility to make sure that all Work is completed in time to support testing and startup. Testing of the systems may begin only after the Engineer has received full documentation and certification by the manufacturer and Contractor of the complete and correct installation of equipment associated with the Work. The Contractor shall also certify to the Engineer that all auxiliary systems and components associated with testing have been correctly installed/constructed and completed.
- C. All equipment testing and operation shall be witnessed by the Engineer and Owner or Owner's designated personnel and shall be performed as required to confirm that the Work has been constructed and/or installed properly and will operate satisfactorily under the specified conditions of service. No power is to be turned on to any piece of equipment and no equipment is to be started or tested by the Contractor outside the presence of the manufacturer's technical representative.
- D. The Contractor must verify the integrity of the Work and make any adjustments, calibrations and/or remedial measures required to prepare the Work for acceptance and performance testing.

1.3 SUBMITTALS

- A. Submit name, address, telephone numbers, and resume of the proposed field services technicians at least 30 days in advance of the services.
- B. Submit test data sheets and performance requirements of each piece of equipment at least 14 days prior to starting related testing.
- C. Submit schedule of proposed dates and times for testing and startup activities at least 14 days prior to start of testing.
- D. Submit a summary of power, lighting, chemical, water, gas, and other process and utility needs necessary for conducting testing and startup at least 14 days prior to start of testing.
- E. Submit a detailed step-by-step description of testing requirements a minimum of 14 days prior to start of testing.
- F. Submit field service technicians report summarizing results of pre-operational checkout, including adjustments and pre-tests, prior to conducting functional testing.
- G. Submit Manufacturer's Certificate of Proper installation.
- H. Submit Test Reports for each piece of equipment or system tested.
- I. Submit summary log of all testing and training activities, by specific equipment item, as applicable.

#### 1.4 UNIT RESPONSIBILITY

- A. A single manufacturer shall assume unit responsibility for all items so specified in each section. Unit responsibility shall require that all items be products of, or guaranteed by, the manufacturer. The manufacturer shall be responsible for all coordination between components and provide all submittals, installation and start-up assistance and certifications on the equipment as a unit.

#### 1.5 QUALITY ASSURANCE

- A. Field service technician shall be competent and experienced in the proper installation, adjustment, operation, testing and startup of equipment and systems being installed. Manufacturer's sales representative and marketing personnel shall not be accepted as field service technicians.
- B. Prior to startup and testing, system components shall be flushed with water and hydraulically checked for leaks, cracks, and defects.
- C. All systems shall be cleaned and purged as required prior to the pre-operational checkouts.
- D. All instruments and controls shall be calibrated through their entire range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made (check that local and SCADA monitoring and control are operational).
- E. At no time during testing, startup, and commissioning activities shall the Contractor allow the facility to be operated in a manner that subjects equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.
- F. No testing of equipment operation shall take place until it has been verified that all lubricants, tools, maintenance equipment, spare parts and O&M manuals have been furnished as specified.
- G. All valve and equipment tagging shall be completed prior to startup.

#### 1.6 PRE-OPERATIONAL CHECKOUT

- A. During this initial inspection, each piece of equipment is to be evaluated for non-dynamic, non-operational concerns. The focus shall be to confirm the readiness of a unit or system for operation in a normal duty cycle during the functional test period. To the maximum extent practical, the full capabilities of each piece of equipment, including remote operation, instrumented control schemes, alternate modes of operation, and emergency operation, should be available prior to physical checkout in order to facilitate and expedite the transition from physical checkout to functional testing.
- B. After the pre-operational checkout is completed, each manufacturer's technical representative and the Contractor shall certify to the Owner, in writing, and on the Manufacturer's letterhead, that the equipment is fully installed in accordance with manufacturer's instructions and operating requirements, and ready to be tested in an operating mode without violation of or voiding any aspect or detail of the manufacturer's warranty.

#### 1.7 PRE-TEST/STARTUP COORDINATION MEETING

- A. A pre-test/startup coordination meeting will be conducted by the Engineer to discuss the overall testing and startup program associated with the equipment being provided under this contract. The Engineer will notify the Contractor of the time and place of the meeting. The purpose of this meeting will be to review the testing and startup requirements, review the contractor's testing plan and readiness to begin testing, and develop a startup plan.
- B. The Contractor, Engineer, and Owner shall have the required representatives at this meeting.
- C. The Contractor shall arrange for attendance of major equipment manufacturer's technical representatives, as needed.

#### 1.8 FUNCTIONAL TESTING

- A. After pre-operational checkout is successfully completed, functional testing shall be performed on all equipment. Functional testing shall be conducted and performed using anticipated operational strategies. All field instrumentation, automatic controls and control strategies shall be demonstrated to operate as designed. In the event of failure to demonstrate satisfactory performance of the system or facility, all necessary alterations, adjustments, repairs and replacements shall be made. Functional testing shall consist of operation of the equipment on normal duty cycles for a sufficient period of time to determine satisfactory operation. Test results shall exercise the full capabilities of all equipment including remote and automatic operation, instrumented control schemes, alternate modes of operation, and emergency operation. Functional testing shall be repeated as often as necessary to the satisfaction of the Owner and Engineer, for the specified duration.
- B. Certification of functional testing shall be performed by the manufacturer using the services of an authorized representative trained in this type service. Written certification shall be filed with the Engineer on the manufacturer's stationary. Written certification shall indicate that tests were made in accordance with the manufacturer's recommendations, that the test and start-up operation has been satisfactory and that the equipment is fully operational under design requirements.

## 1.9 COMMISSIONING

- A. After successful completion of functional testing period, system commissioning shall be conducted over a continuous 14-day period. The Owner will furnish all operating personnel (other than vendor's or contractor's service personnel) needed to operate equipment during the commissioning period. However, the Owner's personnel will perform their duties under the Contractor's direct supervision. The Owner will be responsible for all operational costs (other than Contractor's, subcontractors, or vendors costs) and the Contractor shall bear the costs of all repairs or replacements required to meet the satisfactory completion of the commissioning. The contractor shall provide all necessary personnel and field service personnel of the major equipment suppliers on an on-call, as-needed basis during commissioning. Until commissioning is completed and units and systems are accepted by the Owner as substantially complete, the Contractor shall be fully responsible for the operational and maintenance of all new facilities and systems. Systems and facilities shall operate satisfactorily continuously through the 14-day commissioning period. After repairs, replacements, alterations, and adjustments are made to correct unsatisfactory performance, the commissioning period will be repeated as necessary until operation has operated continuously to the satisfaction of the Owner.

## 2 PRODUCTS (NOT USED)

## 3 EXECUTION

### 3.1 TESTING PREPARATION

- A. Prior to starting field testing the Contractor shall:
  - 1. Complete Work associated with the unit and related processes, including providing and coordinating related manufacturer's technical representative services.
  - 2. Furnish related operating and maintenance manuals, and have on hand necessary testing devices, spare parts, and special tools before testing any unit or system.
  - 3. Provide materials and equipment required to conduct testing, and provide all labor required to aid the manufacturer's technical representatives with their inspection and in making required adjustments to all equipment installed under this contract.
  - 4. Calibrate testing equipment for accurate results.
  - 5. Inspect and clean equipment, devices, connected piping, and structures so they are free of foreign material.
  - 6. Turn rotating equipment by hand and check motor-driven equipment for correct

rotation.

7. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
8. Check power supply to electric-powered equipment for correct voltage.
9. Adjust clearances and torques.
10. Balance HVAC systems, measuring airflow static pressure, and component pressure losses.

### 3.2 FUNCTIONAL TESTING

- A. The Contractor shall:
  1. Begin testing at a time mutually agreed upon by the Owner, Engineer, manufacturer's technical representative(s), and Contractor.
  2. Conduct test until each individual component item or system has achieved a minimum of 24 continuous hours of satisfactory operation and of sufficient duration to achieve confidence in long term operational functionality. Demonstrate that all operational features and controls function during this period while in automatic modes.
- B. Separate items of equipment demonstrated to function properly during subsystem testing may require no further acceptance test if documentation of subsystem testing is acceptable to Engineer.
- C. Startup testing shall not commence until the equipment or system meets unit functional tests requirements specified herein and as required by the manufacturer.

### 3.3 COMMISSIONING

- A. Commissioning follows successful functional testing, and includes the process of putting the facility in operating order, final cleaning, adjusting and balancing of equipment, initial operation of equipment, operating equipment and systems, and demonstration and verification of the completed facility as a unit. Unless otherwise specified, startup testing of the entire facility shall be considered complete when the facility has operated in the manner intended for 14 continuous days without a significant interruption. This period is in addition to any training, field, or startup test periods specified elsewhere. A significant interruption will require the commissioning then in progress to be stopped and restarted after corrections are made.
- B. Test Reports: Prior to initiation of the commissioning period, the Contractor shall certify in writing that:
  1. Hydraulic structures, piping systems, and valves have been successfully tested.
  2. Equipment systems and subsystems have been checked for proper installation, started, and successfully tested to indicate that they are operational.
  3. Systems and subsystems are capable of performing their intended functions.
  4. Facilities and systems are ready for intended operation.
- C. The Contractor shall provide and coordinate manufacturer's startup testing services.
- D. Any and all adjustments, repairs, and corrections necessary to complete startup testing shall be coordinated and completed by the Contractor.
- E. After the facility is operating, the Contractor shall complete the testing of any items of equipment, systems, and subsystems which could not be or were not adequately or successfully tested prior to startup test period.
- F. Substantial completion of the contract will occur after the commissioning of all systems has been completed.

**\*\* END OF SECTION \*\***

SECTION 01 77 00  
CONTRACT CLOSEOUT

1 GENERAL

1.1 DESCRIPTION

- A. This section covers general contract closeout requirements which the Contractor shall be required to perform both during construction and before final acceptance of the project unless otherwise shown on the Drawings or specified elsewhere in these specifications.

1.2 SUBMITTALS

- A. Submit prior to processing of application for final payment:
1. Record Documents
  2. Manufacturer's warranties assembled in a separate binder.
  3. Complete set of Approved Shop Drawings and Samples
  4. Two copies of all Special Bonds, Special Warranties, and Service Agreements.
  5. Consent of Surety to Final Payment
  6. Releases or Waivers of Liens and Claims
  7. Releases from Agreements.
  8. Certificates of Inspection and Occupancy if required by local jurisdiction.
  9. Registry of training sessions conducted and list of attendees for all manufacturer's operation and maintenance training session.
  10. Registry of final maintenance and lubrication of filter and/or oil lube protected equipment.
  11. Registry of all Spare Parts and Special Tools provided to the Owner as required by individual specification sections organized by specification section inclusive of documentation depicting receipt by Owner.
  12. Final Application for Payment: Submit in accordance with procedures and requirements stated in General Conditions.
  13. A final written tabulation, plus other documentation as may be required, of all taxes, including sales tax, paid by the Contractor to assist the Owner in obtaining sales and/or use tax refunds for eligible machinery and equipment used for the primary purpose of reducing or eliminating air or water pollution as provided for in Chapter 48-8-3 (36) and (37) of the Official Code of Georgia.

1.3 RELEASE FROM AGREEMENTS

- A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.
- B. In the event Contractor is unable to secure written releases, inform the Owner of the reasons:
1. Inform Owner of the reasons.
  2. Owner or its representatives will examine the site, and Owner will direct Contractor to complete Work that may be necessary to satisfy terms of the side agreement or special easement.
  3. Should Contractor refuse to perform this Work, Owner reserves the right to have it done by separate contract and deduct the cost of same from the Contract Price, or require the Contractor to furnish a satisfactory Bond in a sum to cover legal claims for damages.

4. When Owner is satisfied that Work has been completed in agreement with the Contract Documents and terms of side agreement or special easement, the right is reserved to waive the requirement for written release if:
  - a. Contractor's failure to obtain such statement is due to the grantor's refusal to sign, and this refusal is not based upon any legitimate claims that Contractor has failed to fulfill the terms of the side agreement or special easement, or
  - b. Contractor is unable to contact or has had undue hardship in contacting the grantor.

#### 1.4 FINAL CLEANING

- A. At the completion of the work, the Contractor shall:
  1. Schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.
  2. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.
  3. Employ experienced workmen or professional cleaners for final cleaning.
  4. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and of concealed spaces.
  5. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces to shine finish.
  6. Repair, patch, and touch up marred surfaces to specified finish to match adjacent surfaces.
  7. Broom clean paved surfaces; rake clean other surfaces of grounds.
  8. Clean screens on air intake vents.
  9. Upon completion of the work, Contractor shall remove all rubbish from and about the site of the work, and all temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which he or any of his Subcontractors may have used in the performance of the work and leave the site with an appearance acceptable to the Engineer.
  10. The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver over such materials and equipment in a bright, clean, polished and new-appearing condition.
  11. Contractor shall replace dirty filters and burned out lights as required; clean all glass surfaces and floors and polished so as to leave work in a clean and new appearing condition.
  12. Restoration of Landscape Damage
    - a. Any landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. The Engineer will decide what method of restoration shall be used.
  13. Post-Construction Cleanup or Obliteration
    - a. The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction.
- B. Contractor shall maintain cleaning until project, or portion thereof, is occupied by the Owner.

#### 1.5 LUBRICATION SURVEY

- A. A lubrication survey, made by a lubricant supply firm, subject to the approval of the Owner

shall be provided and paid for by the Contractor.

- B. The lubrication survey shall list all equipment, the equipment manufacturer's lubrication recommendations, and an interchangeable lubricants tabulation standardizing and consolidating lubricants whenever possible.
- C. The Contractor shall supply all lubricants, applicators and labor for lubricating the equipment, in accordance with manufacturer's recommendations, for field testing and prior to final acceptance. A supply of required lubricants sufficient for start-up and one year of operation shall also be supplied by the Contractor.
- D. Two (2) copies of the approved lubrication survey shall be furnished to the Engineer prior to final acceptance.

#### 1.6 SPARE PARTS AND SPECIAL TOOLS

- A. Provide spare parts and special tools in accordance with Section 01 78 43, Spare Parts, and the individual equipment specifications.

#### 1.7 EQUIPMENT START-UP SERVICES

- A. Equipment start-up period, for the training of plant personnel, shall begin after satisfactory completion and acceptance of the field tests and coincidentally with the certified date of substantial completion for the part of the work for which the equipment is included. If the equipment is not covered by a certificate of substantial completion for a part of the work, the period shall begin upon substantial completion of the project.
- B. During the equipment start-up period the Contractor shall furnish, at no additional cost to the Owner the services of factory trained representatives of the equipment manufacturers for the equipment designated in the Specifications to:
  - 1. Assist in the start-up and operations of the equipment.
  - 2. Assist in the training of plant personnel, designated by the Owner in the proper operation and maintenance of the equipment.
- C. The Owner shall provide the necessary plant personnel to be instructed in the operation and maintenance of the equipment. The Owner's personnel shall operate all equipment.
- D. The Contractor shall pay for fuel, power, and chemicals consumed up to the date of "certified substantial completion" except as otherwise specified herein.
- E. Contractor shall be available to promptly repair all work during the start-up period so as to cause minimum disruption to the total plant operation.
- F. Upon completion of a minimum of fourteen (14) consecutive and continuous days of satisfactory operation, or the number of days called for in the Technical Specifications, the Owner will assume operation and operating cost of the equipment. If the equipment malfunctions during this start-up period, the start-up period will be repeated until satisfactory operation is achieved.
- G. In the event a system, equipment or component proves defective or is unable to meet specified performance criteria, the Contractor shall replace the defective item and the minimum one (1) year guarantee period, or the guarantee period called for in the Technical Specifications for the item shall start after satisfactory replacement and testing of the item.

#### 1.8 FINAL CLEANUP/SITE REHABILITATION

- A. Before finally leaving the site, the Contractor shall wash and clean all exposed surfaces which have become soiled or marked, and shall remove from the site of work all accumulated debris and surplus materials of any kind which result from his operation, including construction equipment, tools, sheds, sanitary enclosures, etc. The Contractor shall leave all equipment, fixtures, and work, which he has installed, in a clean condition. The completed project shall be turned over to the Owner in a neat and orderly condition.
- B. The site of the work shall be rehabilitated or developed in accordance with other sections of the Specifications and the Drawings. In the absence of any portion of these requirements, the Contractor shall completely rehabilitate the site to a condition and appearance equal or

superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by the Owner.

C. Disposal of Surplus Materials:

1. Unless otherwise shown on the drawings, specified or directed, the Contractor shall dispose of all surplus excavated materials and materials and equipment from demolition, legally, off the site, and shall provide his own suitable, off-site spoil area, or on a site designated by the Owner.
2. The Owner shall have the opportunity to inspect any materials removed prior to disposal by the Contractor. If said materials are determined to be salvageable by the Owner, the Contractor shall transport said material to an area designated by the Owner.

1.9 FINAL INSPECTION

- A. Final cleaning and repairing shall be so arranged as to be finished upon completion of the construction work. The Contractor will make his final cleaning and repairing, and any portion of the work finally inspected and accepted by the Engineer shall be kept clean by the Contractor, until the final acceptance of the entire work.
- B. When the Contractor has finally cleaned and repaired the whole or any portion of the work, he shall notify the Engineer that he is ready for final inspection of the whole or a portion of the work, and the Engineer will thereupon inspect the work. If the work is not found satisfactory, the Engineer will order further cleaning, repairs, or replacement.
- C. When such further cleaning or repairing is completed, the Engineer, upon further notice, will again inspect the work. The "Final Payment" will not be processed until the Contractor has complied with the requirements set forth, and the Engineer has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

1.10 HAZARD CONTROL

- A. The Contractor shall store volatile wastes in covered metal containers and remove from premises daily.
- B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.
- C. Burning or burying rubbish and waste materials on the site shall not be allowed.
- D. Disposal of volatile wastes into sanitary or storm sewers shall not be allowed.

1.11 PROJECT CLOSE OUT

- A. As construction of the project enters the final stages of completion, the Contractor shall, in concert with accomplishing the requirements set forth in the Contract Documents, attend to or have already completed the following items as they apply to his contract:
  1. Scheduling equipment manufacturers' visits to site.
  2. Required testing of project components.
  3. Scheduling start-up and initial operation.
  4. Scheduling and furnishing skilled personnel during initial operation.
  5. Correcting or replacing defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by the Engineer's "Punch" Lists.
  6. Attend to any other items listed herein or brought to the Contractor's attention by the Engineer.
- B. Just before the Engineer's Certificate of Substantial Completion is issued, the Contractor shall accomplish the cleaning and final adjustment of the various building components as specified in the Specifications and as follows:

1. Clean all glass and adjust all windows and doors for proper operation.
  2. Clean all finish hardware after adjustment for proper operation.
  3. Touch up marks or defects in painted surfaces and touch up any similar defects in factory finished surfaces.
  4. Wax all resilient flooring materials.
  5. Remove bitumen from gravel stops, fascias, and other exposed surfaces.
  6. Remove all stains, marks, fingerprints, soil, spots, and blemishes from all finished surfaces, tile, stone, brick, and similar surfaces.
- C. In addition, and before the Certificate of Substantial Completion is issued, the Contractor shall submit to the Engineer (or to the Owner if indicated) certain records, certifications, etc., which are specified elsewhere in the Contract Documents. A partial list of such items appears below, but it shall be the Contractor's responsibility to submit any other items which are required in the Contract Documents:
1. Test results of project components.
  2. Certification of equipment or materials in compliance with Contract Documents.
  3. Operation and maintenance instructions or manuals for equipment.
  4. One set of neatly marked-up record drawings showing as-built changes and additions to the work under his Contract.
  5. Any special guarantees or bonds (Submit to Owner).

\*\* END OF SECTION \*\*

SECTION 01 78 23  
OPERATION AND MAINTENANCE DATA SUBMITTALS

1 GENERAL

1.1 SUMMARY

- A. Manuals shall be provided for equipment and systems furnished under the Contract that require maintenance, operation, or modification, including any testing or training equipment. Provide manuals for each item of equipment and its component parts.
- B. Manuals shall be provided in printed and electronic formats.
- C. All manuals shall be in English. Any foreign language portions of off-the-shelf manuals shall be removed.
- D. Submittal of manuals as required by this section implicitly conveys the right from the manufacturer to the Owner to reproduce the document for his own use.

1.2 QUALITY ASSURANCE

- A. Off-the-Shelf equipment manuals shall be edited and annotated specifically for this Project by personnel trained and experienced in maintenance and operation of described products.
- B. The production quality of printed documents shall be equivalent to offset printing. If offset printed (or equivalent) materials are not available, photocopying from original documents using a properly adjusted plain paper copier will be accepted; however, photocopies of materials containing photographs will not be accepted. Photocopies will be de-speckled and contain less than 5% skew.

1.3 MANUAL DESCRIPTION

- A. Off-the-Shelf Equipment Manuals: These manuals are the equipment manufacturer's standard pre-printed operation and maintenance manuals, specifically edited for this project as follows:
  - 1. If material covers more than one product type, the applicable information for the equipment supplied shall be clearly indicated by bubbles or arrows. Highlighting that obliterates the information when photocopied or scanned is not acceptable.
  - 2. If material includes equipment information not relevant to the project, this information shall be crossed out or otherwise clearly redacted.
- B. System Manuals: If a major equipment item is specified as a "system" (i.e., comprised of components from several manufacturers furnished on this project by a single entity assigned "system responsibility"), the operation and maintenance material for the entire system shall be included in a single manual with appropriate cross-references and indexing.
- C. Minor Components: Any equipment items or components that are typically replaced instead of repaired or have no published operation and maintenance material shall be identified by catalog cuts. If catalog cuts are included in the submittal of an Off-the-Shelf or System Manual, the catalog name and number, and the company name, address and telephone number shall be provided on the catalog cut or typewritten on a separate sheet of paper.

1.4 CONTENT OF MANUAL

- A. General: All material shall be labeled to identify the specific function that the equipment serves in the facility. The manuals shall contain, at a minimum:
  - 1. Data required to maintain equipment during equipment service life.
  - 2. Complete preventive maintenance instructions required to assure satisfactory performance and longevity of the equipment.
  - 3. Maintenance and overhaul instructions including detailed assembly drawings with part numbers, parts list, and instructions for ordering spare parts.

4. Lubrication instructions listing points to be greased or oiled, recommending type, grade, temperature range of lubricants, and frequency of lubrication.
  5. List of electrical relay settings and control and alarm contact settings.
  6. Electrical interconnection wiring diagram for equipment furnished, including all control systems.
- B. Project Information: Neatly typewritten table of contents for each volume, arranged in systematic order.
1. Contractor, name of responsible principal, address and telephone number.
  2. A list of each product required to be included, indexed to content of the volume.
  3. List, with each product, name, address and telephone number of:
    - a. Subcontractor or installer.
    - b. Maintenance Contractor, as appropriate.
    - c. Identify area of responsibility of each.
    - d. Local source of supply for parts and replacement.
    - e. Manufacturer
  4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
  5. A Table of Contents for each equipment manual that reflects all procedure numbers, page numbers, figure numbers, and tables, as well as the volumes, chapters, and/or sections of each manual.
- C. Product Data:
1. Include only those sheets which are pertinent to the specific product.
  2. Annotate each sheet to:
    - a. Clearly identify specific product or part installed.
    - b. Clearly identify data applicable to installation.
    - c. Delete references to inapplicable information.
- D. Drawings:
1. Supplement product data with drawings as necessary to clearly illustrate:
    - a. Relations and component parts of equipment and systems.
    - b. Control and flow diagrams.
  2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
  3. Do not use Project Record Documents as maintenance drawings.
- E. Written text, as required to supplement product data for the particular installation:
1. Organize in consistent format under separate headings for different procedures.
  2. Provide logical sequence of instructions of each procedure.
- F. Copy of each warranty, bond and service contract issued.
1. Provide information sheet for Owner's personnel, give:
    - a. Proper procedures in event of failure.
    - b. Instances which might affect validity of warranties or bonds.
- G. Equipment Data (for use in Owner's Computerized Maintenance Management System)
1. Provide equipment data in Excel spreadsheet format:
    - a. Equipment ID (ISA tag number or as shown on drawings)

- b. Sub-unit
- c. Description
- d. Area (Name of Water Reclamation Facility e.g. NC – Noonday Creek)
- e. Equipment Type (e.g. check valve)
- f. Manufacturer
- g. Model Number
- h. Serial Number
- i. Building
- j. Building Level

#### 1.5 FORM OF SUBMITTALS

- A. Prepare data in printed format as an instructional manual for use by Owner's personnel as required.
- B. Format for Printed and Bound Document:
  - 1. Size: 8-1/2 inches x 11 inches.
  - 2. Paper: 20 pound minimum, white, for typed pages.
  - 3. Text: Manufacturer's printed data, or neatly typewritten.
  - 4. Drawings:
    - a. Provide reinforced punched binder tap, bind in with text.
    - b. Whenever possible, material shall be 8-1/2 inches by 11 inches or 11 inches by 17 inches z-folded to 8-1/2 inches by 11 inches. If necessary, materials larger than 11 inches by 17 inches may be provided; however, they shall be folded to approximately 8-1/2 inches by 11 inches so that the title block is clearly visible without unfolding.
  - 5. Provide fly-leaf for each separate product, or each piece of operating equipment.
    - a. Provide typed description of product, and major component parts of equipment.
    - b. Provide mylar-reinforced indexed tabs, labeled on both sides. Slide-in type tabs are not acceptable.
  - 6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
    - a. Title of Project.
    - b. Identity of separate structure as applicable.
    - c. Identity of general subject matter covered in the manual.
  - 7. Binders:
    - a. Commercial quality three post binders with durable, cleanable covers and clear plastic slip-in pockets on cover and spine.
    - b. Maximum Post Width: 2 inches.
    - c. Color of binders to be selected by the Owner.
    - d. When multiple binders are used, collate the data into related consistent groupings.
- C. Electronic Format:
  - 1. O&M manuals are to be produced in Adobe Acrobat's Portable Document Format (PDF). Normal drawing orientation shall be maintained.
  - 2. Create one PDF document (PDF file) for each equipment O&M Manual. The entire manual shall be created as a single PDF file via scanning or other conversion method. Drawings or other graphics must be converted to PDF format and made part of the one

PDF document. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.

3. Images shall be scanned at a resolution of 300 dpi or greater. Perform Optical Character Recognition (OCR) capture on all images, using capture option that ensures text is searchable and selectable. Word searches of the PDF document must operate successfully to demonstrate OCR compliance.
4. Create bookmarks in the navigation frame, for each entry in the Table of Contents. Three levels deep is usually enough (i.e., "Chapter," "Section," "Sub-section").
5. Thumbnails must be generated for each PDF file.
6. Set the opening view for PDF files as follows:
  - a. Initial View: Bookmarks and Page
  - b. Magnification: Fit In Window
  - c. Page Layout: Single Page
7. Set the file to open to the cover page of the manual, with bookmarks to the left, and the first bookmark linked to the title page.
8. Fill out the Document Properties Description as follows:
  - a. Title: Enter the Title of the O&M Manual, e.g. "Return Sludge Pump."
  - b. Subject: Enter the Subject "Operation and Maintenance Manual."
  - c. Author: Enter the name of the Equipment Vendor, e.g. "Acme."
  - d. Keywords: Enter the word "Facility", followed by the Owner's facility name. Enter the word "Specification", followed by the submittal specification section number.
9. Submit final versions of the O&M manuals on compact disks. Label the CDs and the jewel cases as follows:
  - a. Facility Name.
  - b. Manufacturer Name.
  - c. Equipment name and O&M title spelled out in complete words. (example: "Operations and Maintenance Manual" "Hose Pumps").
  - d. Specification Section No. (example: "Section 46 33 44").
  - e. Date and file name (example: "12-25-10," "12345\_01.PDF").

#### 1.6 SUBMITTAL SCHEDULE

- A. Submit an electronic copy of the draft Operation and Maintenance Manuals to the Owner for review prior to the shipment of the equipment. Payment for the particular item of equipment, whether stored or installed, will limited to 75% of the invoiced equipment value until submittal is made.
- B. Submit two (2) hard copies and two (2) electronic copies (on compact disk(s)) of the final Operation and Maintenance Manuals, incorporating any review comments by the Owner, no later than thirty days prior to the scheduled date for training on the equipment. Applications for Payment will not be processed by the Owner, or the amount of payment may be reduced, until the proper material is submitted.

## 2 PRODUCTS (NOT USED)

## 3 EXECUTION (NOT USED)

**\*\* END OF SECTION \*\***

## SECTION 01 78 36

### WARRANTIES

#### 1 GENERAL

##### 1.1 PROJECT MAINTENANCE AND WARRANTY

- A. Maintain and keep in good repair the improvements covered by these drawings and specifications during the life of the contract.
- B. The Contractor shall warrant for a period of 1-year from the date of Owner's written acceptance of certain segments of the Work and/or Owner's written final acceptance of the Project, as defined in the Contract Documents, that the completed Work is free from all defects due to faulty products or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect throughout the warranty period.
- C. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.
- D. In the event of multiple failures of major consequences prior to the expiration of the 1-year warranty described above, the affected unit shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new 1-year warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failures shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear, or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures, or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over- or under-lubrication, and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the 1-year warranty. Should multiple failures occur in a given time, all products of the same size and type shall be disassembled, inspected, modified or replaced, as necessary and re-warranted for 1-year.
- E. The Contractor shall, at his own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals or shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the Work performed by him. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.
- F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the contract. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.
- G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for a period of one year from the date of final acceptance. In the

event the repairs and maintenance are not made immediately and it becomes necessary for the Owner of the road to make such repairs, the Contractor shall reimburse the Owner of the road for the cost of such repairs.

- H. In the event the Contractor fails to proceed to remedy the defects of which he has been notified within 15-days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the drawings and specifications, and to hold the Contractor and the sureties on his bond liable for the cost and expense thereof.
- I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at his home office.
- J. After the Owner has made final acceptance of the work, the Contractor shall provide written notice to the Owner and Engineer of the agreed-upon start and end date for the 1-year warranty period.
- K. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability with the law of the place of construction.

#### 1.2 MANUFACTURER WARRANTIES

- A. Manufacturer warranties shall be assembled and submitted as part of the informational submittals to be submitted as part of the project closeout procedures per Section 01 77 00, Contract Closeout.

\*\* END OF SECTION \*\*

SECTION 01 78 39  
PROJECT RECORD DOCUMENTS

1 GENERAL

1.1 SCOPE

- A. The work under this includes, but is not necessarily limited to, the compiling, maintaining, recording and submitting of project record documents as herein specified.
- B. Record documents to be prepared and submitted by the Contractor include, but are not limited to Record Drawings, Specifications, Change orders and other modifications to the Contract, Engineer field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums, Reviewed shop drawings, product data and samples, Test records, and Record drawings.
- C. The Contractor shall maintain on the Project site an updated set of Record Drawings.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in the Contractor's field office, apart from documents used for construction. Provide files and racks for storage of documents. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with format of these Specifications.
- C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes. Maintain at the site for the Owner one copy of all record documents.
- D. Make documents and samples available at all times for inspection by Engineer and Design Consultant.
- E. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

1.3 QUALITY ASSURANCE

- A. Unless noted otherwise, Record Drawings shall provide dimensions, distances and coordinates to the nearest 0.01 foot for all pertinent items constructed by the Contractor.

1.4 SPECIFICATIONS

- A. Legibly mark each section to record changes made by Requests for Information (RFI), field order, clarification memoranda, or by change order.

1.5 SUBMITTAL

- A. At contract closeout, deliver Record Documents to the Engineer.
- B. Accompany submittal with transmittal letter, in duplicate, containing Date, Project title and number, Contractor's name and address, Title and number of each record document, and Signature of Contractor or Contractor's authorized representative.

2 PRODUCTS (NOT USED)

3 EXECUTION

3.1 RECORD DRAWINGS

- A. The Contractor must maintain an up-to-date field record set of drawings by marking changes and other information directly on a clean set of full-size contract drawings. The Engineer will periodically review the record drawings to confirm that the recorded information is current.

B. Making Entries on Record Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
  - a. Color Coding:
    - 1) Green when showing information deleted from Documents.
    - 2) Red when showing information added to Documents.
    - 3) Blue and circled in blue to show notes.
2. Date all entries.
3. Legibly mark to record actual changes made during construction, including, but not limited to:
  - a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
  - b. Horizontal and vertical locations, to the nearest one-hundredth foot, of existing and new underground facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
  - c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
  - d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
  - e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, Written Amendment, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.

\*\* END OF SECTION \*\*

## SECTION 01 78 43

### SPARE PARTS

#### 1 GENERAL

##### 1.1 SCOPE

- A. The Work covered by this section includes furnishing all spare parts as identified in the individual equipment specifications.

##### 1.2 SUBMITTALS

- A. Provide a list of all spare parts and tools to be provided as part of the Work, including manufacturer/supplier name and contact information.
- B. Provide a list of other spare parts not specified to be provided in the individual equipment specifications that are recommended by the manufacturer to assure efficient operation of the equipment for a period of 120 days for the particular installation.

##### 1.3 SOURCE OF SUPPLY

- A. Provide spare parts manufactured by the original equipment manufacturer.
- B. Provide maintenance materials identical to those installed.

##### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver required items to the Place of the Work and store in temporary locations determined by Contractor or permanent locations designated by Owner.
- B. Deliver and store items in original factory packaging or other securely packaged form.
- C. Identify, on carton or package, manufacturer's name, name of item, and part number, as applicable. Identify equipment, system, area, room no., etc. for which each item is intended.
- D. Maintain an inventory list of all items delivered. For each item, record description of item, quantity, and location where stored.
- E. Stored items shall remain in Contractor's care, custody, and control until acceptance of the Work. Protect stored items against theft or damage.
- F. Handle items as necessary, until stored in permanent locations designated by Owner.

#### 2 PRODUCTS (NOT USED)

#### 3 EXECUTION

##### 3.1 GENERAL

- A. Furnish parts and materials in manufacturer's unopened cartons, boxes, crates, or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. Clearly mark and identify packaging as to their contents and storage instructions.
- B. Furnish special tools in painted metal tool boxes properly labeled and equipped with good grade cylinder locks and duplicate keys.
- C. Deliver parts and materials to the Owner upon completion of the Work or when the Owner assumes partial utilization in accordance with the specifications.
- D. Provide a letter of transmittal including the following:
  - 1. Date of letter and transfer of parts and materials.

2. Contract title and project number.
  3. Contractor's name and address.
  4. A complete inventory of the parts and material listing the applicable specification section for each.
  5. A place for the Owner to sign and signify receipt of the parts and materials.
- E. Maintain responsibility for loss or damage to parts and materials until they are received and accepted by the Owner.

**\*\* END OF SECTION \*\***

SECTION 01 79 00  
DEMONSTRATION AND TRAINING

1 GENERAL

1.1 SCOPE

- A. The Work covered by this section includes training the Owner in the operation and maintenance of all new equipment, valves, systems, etc.

1.2 SUBMITTALS

- A. Approved Operation and Maintenance Manuals
- B. Video recordings of training classes recorded on DVD

1.3 QUALITY ASSURANCE

- A. Training classes shall be conducted by an instructor who is certified by the manufacturer and is qualified in the operation and maintenance of the particular equipment. Any instructor who is not a direct employee of the manufacturer must provide documentation from the manufacturer stating the individual, by name, has been formally trained in the installation, operation, and maintenance of the equipment and is authorized to train the Owner in the operation of the equipment.

1.4 TRAINING

- A. Manufacturer shall conduct two (2) training classes for the Owner's personnel. The training classes shall be conducted on two consecutive days and during regular working hours.
- B. Training classes shall not be conducted concurrently with startup and testing; therefore, manufacturer shall allow for additional trips to the project site.
- C. Training classes shall not be scheduled or conducted until the manufacturer has certified that the equipment is properly installed and operational; Operation and Maintenance Manuals are finalized and approved; as-built drawings are submitted; valve, equipment and piping identification is complete; and all software programming is complete.
- D. Training classes shall be scheduled with the Owner a minimum of one (1) week prior to conducting the class.
- E. Training classes shall be videotaped by the Contractor.
  - 1. Each training class shall be recorded on a separate video. Do not combine training classes on one video.
  - 2. Video shall be high quality using a video camera with minimum 720p display resolution.
  - 3. Tripod(s) shall be used so that the video image is stable.
  - 4. Microphones shall be used so that audio is clear and audible.
  - 5. Video shall be recorded on DVD-R format discs.
  - 6. Provide clear plastic cases for DVDs.
  - 7. Provide typed labels for the DVD and DVD case with the following information.
    - a. Project title
    - b. Equipment name
    - c. Date of recording
  - 8. Two copies of each video shall be provided.

\*\* END OF SECTION \*\*

SECTION 02 41 16  
STRUCTURE DEMOLITION

1 GENERAL

1.1 SCOPE

- A. The work in this Section consists of furnishing all material and equipment and performing all labor necessary for demolishing and disposing of all materials from existing structures, piping and other designated facilities indicated on the drawings. Work includes all excavation and backfilling required for removing existing facilities.
- B. Facilities to be demolished include the following:
  - 1. Existing ferrous chloride feed system including bulk storage tanks, chemical feed pumps, control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  - 2. Existing sodium hypochlorite feed systems including bulk storage tanks, chemical feed pumps, control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  - 3. Existing sodium hydroxide feed systems including chemical feed pumps, control panels, chemical piping, electrical conduit and wiring, and appurtenances.
  - 4. Existing sodium bisulfite feed pumps, control panels, associated piping, and appurtenances.
  - 5. Existing sulfuric acid feed pumps, control panels, associated piping, and appurtenances.
  - 6. Two (2) abandoned chemical storage tanks located at rear of treatment plant near old chemical building.

1.2 SUBMITTALS

- A. The Contractor shall submit a written request, to include a detailed demolition procedure, to the Owner for approval at least 10 days before demolition is started. The demolition procedure shall include a detailed description of the methods and equipment to be used for each operation and the sequence of work. The demolition procedures shall provide for safe conduct of work, protection of the property and new work, which is to remain undisturbed and coordination with other work or operation which may be in progress. The submittal shall also address the installation of the temporary systems.

2 PRODUCTS (NOT USED)

3 EXECUTION

3.1 TEMPORARY FACILITIES

- A. Install temporary facilities as specified in Section 01 50 00, Temporary Facilities and Controls, as shown on the Drawings, and as required to accomplish work and maintain operation of the treatment plant.
- B. Temporary facilities shall operate for a minimum of 48 hours without failure prior to beginning demolition activities.

3.2 DEMOLITION

- A. In addition to these specifications, the Contractor shall utilize the demolition details and requirements noted and detailed on the Drawings.
- B. All material shall be removed as necessary for construction, or in any event, to a minimum depth of three feet below finished grades as shown on the Drawings. The Contractor will be responsible for any damage caused to other structures, and shall be held liable for any

and all repairs, replacement of parts or renovations required to restore any structure, portion of structure, equipment or items, not intended for demolition. The Contractor shall restore any damaged facilities to their condition prior to demolition provided the damage was result of the demolition. If the Contractor does not repair any such damage immediately, or if the repairs are not suitable to the Owner, the Owner reserves the right to have such repairs made by another party and deduct the cost of required repairs from money due Contractor.

- C. Dust-tight, weather-tight partitions shall be erected to protect existing facilities from dust and weather while wrecking is in progress and until such time as closures have been made. Partitions may be constructed of wood and shall have a covering of tarred roofing felt on the weather side.

### 3.3 DISPOSAL

- A. All materials designated to be demolished and removed shall become the property of the Contractor, unless noted otherwise.
- B. The Contractor shall remove all demolished structures, piping and materials from the work site.
- C. All demolished structures, equipment and materials, which are either left in place or removed to the disposal site, shall be in a non-hazardous condition.

**\*\* END OF SECTION \*\***

SECTION 06 80 00  
FIBERGLASS REINFORCED PLASTIC PRODUCTS

1 GENERAL

1.1 SCOPE

- A. The work covered by this section includes furnishing all labor, materials, and equipment required to install fiberglass reinforced plastic grating, railing, shapes and appurtenances as shown on the drawings and/or specified herein.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
  - 1. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications:
    - a. Drawings showing plan, elevation, and appropriate cross sections of the products being provided.
    - b. Complete engineering data including, but not limited to, descriptive data and material specifications, as appropriate, to support the design of the products being provided.
    - c. A complete description of the warranty to be provided.
  - 2. Fiberglass reinforced plastic platform(s) for the chemical containment areas shall be designed by the manufacturer and signed and sealed by a professional engineer registered in the State of Georgia.

1.3 STORAGE AND PROTECTION

- A. Materials shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

1.4 WARRANTIES AND BONDS

- A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01 78 36, Warranties.
- B. The manufacturer shall provide a warranty against defective or deficient workmanship and materials under normal use, operation and service. The warranty shall end three (3) years from completion of the project or from date of Engineer's acceptance of the products. The warranty shall be in printed form and apply to all similar products.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Approved manufacturers include:
  - 1. Fibergate Composite Structures, Inc., Dallas, TX
  - 2. Strongwell Corporation, Bristol, VA
  - 3. Or equal

2.2 FIBERGLASS REINFORCED PLASTIC REQUIREMENTS

- A. Material: Fiberglass reinforced vinyl ester
- B. Physical Properties
  - 1. Tensile Strength (Longitudinal): Minimum 30,000 PSI per ASTM D638
  - 2. Tensile Strength (Transverse): Minimum 7,000 PSI per ASTM D638
  - 3. Tensile Modulus (Longitudinal): Minimum  $2.5 \times 10^6$  PSI per ASTM D638

4. Tensile Modulus (Transverse): Minimum  $0.8 \times 10^6$  PSI per ASTM D638
  5. Flexural Strength (Longitudinal): Minimum 30,000 PSI per ASTM D790
  6. Flexural Strength (Transverse): Minimum 10,000 PSI per ASTM D790
  7. Flexural Modulus (Longitudinal): Minimum  $1.6 \times 10^6$  PSI per ASTM D790
  8. Flexural Modulus (Transverse): Minimum  $0.8 \times 10^6$  PSI per ASTM D790
  9. Compressive Strength (Longitudinal): Minimum 30,000 PSI per ASTM D695
  10. Compressive Strength (Transverse): Minimum 15,000 PSI per ASTM D695
  11. Compressive Modulus (Longitudinal): Minimum  $2.5 \times 10^6$  PSI per ASTM D695
  12. Compressive Modulus (Transverse): Minimum  $0.8 \times 10^6$  PSI per ASTM D695
  13. Short Beam Shear Strength (Longitudinal): Minimum 4,500 PSI per ASTM D2344
  14. Impact Strength – Izod (Longitudinal): Minimum 25 ft-lbs/in per ASTM D256
  15. Impact Strength – Izod (Transverse): Minimum 4 ft-lbs/in per ASTM D256
  16. Density: 0.06 – 0.07 lbs/in<sup>3</sup>
  17. 24-Hour Water Absorption: Maximum 0.6% by weight per ASTM D570
  18. Coefficient of Thermal Expansion:  $7.0 \times 10^{-6}$  in/in/°F per ASTM D696
  19. Flame Spread Rating: ≤25 per ASTM E84, Class 1
  20. Self-extinguishing per ASTM D635
- C. All materials shall be UV resistant.
1. Fiberglass reinforced plastic products shall have ultraviolet stabilizers in the resin to inhibit ultraviolet degradation.
  2. Fiberglass reinforced plastic products shall have a synthetic surfacing veil applied on exterior surfaces to protect against weather and inhibit ultraviolet degradation.
  3. Fabricate fiberglass reinforced products exposed to outdoor conditions with an additional 1-mil thick UV coating to shield product from UV light.
- D. Seal exposed fibers with fiberglass cutting sealant.

### 2.3 GRATING

- A. Pultruded I-bars with cross-rods spaced maximum 6" on center.
- B. Bar Depth
  1. 0" to 42" Span: 1½"
  2. 42" to 60" Span: 2"
- C. Loading: Minimum 150 lbs/ft<sup>2</sup>
- D. Deflection: Maximum ¼"
- E. Skid resistant surface; grit adhesively bonded.
- F. Provide extra stiffness around openings.
- G. Color: Gray

### 2.4 STRUCTURAL SHAPES

- A. Pultruded profiles that satisfy visual requirements of ASTM D4385
- B. Use glass strand rovings for longitudinal strength.
- C. Use continuous strand glass mats or stitched reinforcements for transverse strength.
- D. Color: Gray

### 2.5 HANDRAIL

- A. Dimesions
  - 1. Square: 2" x 2" x minimum 0.156" thick tube
  - 2. Round: 1.90" OD x minimum 0.195" thick tube
- B. Color: Yellow

## 2.6 CONNECTING HARDWARE

- 1. All metallic hardware shall be titanium unless otherwise noted.
- 2. FRP hardware, bolts, threaded rods, nuts, and washers shall be FIBREBOLT by Strongwell, Corporation or Dynaform by Fibergrate Composite Structures, Inc.
- 3. For adhesive FRP concrete anchors, lubricant shall be removed from embedded end of threaded rod prior to installation.

## 3 EXECUTION

### 3.1 INSTALLATION

- A. Install fiberglass reinforced hand rail and accessories in accordance with the Manufacturers requirements to produce a finished product that is clean and demonstrates true craftsmanship.
- B. If fiberglass materials are cut in the field, seal exposed fibers with fiberglass field cutting sealant.

### 3.2 CERTIFICATION

- A. A manufacturer's representative that is qualified in the product requirements shall fully inspect and certify the installation. Written certifications shall be provided that state the product is installed properly and will be warranted as required by the specifications.

\*\* END OF SECTION \*\*

## SECTION 09 91 00

### PAINTING

#### 1 GENERAL

##### 1.1 SCOPE OF WORK

- A. The work covered by this section includes furnishing all labor, materials, and equipment required to accomplish all painting as specified herein and shown on the Drawings.
- B. In general, work included under this section shall include the surface preparation, shop priming, field priming, and/or field painting of all exposed items and surfaces throughout the project, unless otherwise indicated.
- C. All exposed items and surfaces shall be painted using the appropriate paint system as specified herein. Coating system schedules and finish schedules may be provided herein and/or on the Drawings, which identify specific paint systems and paint colors to be used on specific items and surfaces. However, these schedules do not necessarily cover all items to be painted. Where the selection of a specific painting system for a particular application is not clear, it shall be the responsibility of the Contractor to request clarification from the Engineer.
- D. Surface preparation, priming, and coats of paint specified are in addition to shop priming and surface pretreatment specified in other sections, unless otherwise indicated.
- E. All exposed surfaces shall be painted except where the natural finish of the material is obviously intended to be the finished surface or if the surface is specifically noted not to be painted.
- F. In general, items to be painted include:
  - 1. Interior walls and floor of chemical building
  - 2. Interior and exterior exposed PVC/CPVC pipe

##### 1.2 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

##### 1.3 SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications:
  - 1. Product Data
    - a. Submit Manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
  - 2. Color Samples
    - a. Submit Manufacturer's color samples showing full range of standard colors.
- C. Manufacturer's Quality Assurance
  - 1. Submit Manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- D. Warranty
  - a. Submit a complete description of the warranty to be provided.
- E. Painting Schedule
  - 1. Contractor shall submit a schedule of all items (structures, equipment, pipe, etc.) to be

painted prior to beginning painting operations. Schedule shall include, but not be limited to, items to be painted, surface preparation, paint system, and color. The schedule shall be submitted to the Engineer for approval at which time the Engineer will select the colors to be used that are not specified herein or on the Drawings.

#### 1.4 QUALITY ASSURANCE

##### A. Manufacturer's Qualifications

1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single Source Responsibility
  - a. Coatings and coating application accessories shall be products of a single manufacturer.

##### B. Applicator's Qualifications

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this work.
2. Applicator's Personnel
  - a. Employ persons trained for application of specified coatings.

##### C. Pre-application Meeting

1. Convene a pre-application meeting two weeks before start of application of coating systems. Attendance of parties directly affecting work of this section, including Contractor, Engineer, Applicator, and Manufacturer's representative, is required. The meeting shall cover, but not be limited to, the following:
  - a. Environmental requirements.
  - b. Protection of surfaces not scheduled to be coated.
  - c. Surface preparation.
  - d. Application.
  - e. Repair.
  - f. Field quality control.
  - g. Cleaning.
  - h. Protection of coating systems.
  - i. One-year inspection.
  - j. Coordination with other work.

##### D. Manufacturer's Representative During Painting Operations

1. An authorized Manufacturer's representative shall be present at the start-up and weekly during painting operations. Such representative shall instruct and observe the Contractor's and Applicator's work and shall, at the completion of work, certify in writing to the Engineer that the Manufacturer's application recommendations have been adhered to. The cost of this work shall be borne by the Contractor.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### A. Delivery

1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
  - a. Coating or material name.
  - b. Manufacturer.
  - c. Color name and number.

- d. Batch or lot number.
  - e. Date of manufacture.
  - f. Mixing and thinning instructions.
- B. Storage
- 1. Store materials in a clean dry area and within temperature range in accordance with Manufacturer's instructions.
  - 2. Keep containers sealed until ready for use.
  - 3. Do not use materials beyond Manufacturer's shelf life limits.
- C. Handling
- 1. Protect materials during handling and application to prevent damage or contamination.

## 1.6 ENVIRONMENTAL REQUIREMENTS

### A. Weather

- 1. Air and Surface Temperatures
  - a. Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with Manufacturer's instructions.
- 2. Surface Temperature
  - a. Minimum of 5 °F (3 °C) above dew point.
- 3. Relative Humidity
  - a. Prepare surfaces and apply and cure coatings within relative humidity range in accordance with Manufacturer's instructions.
- 4. Precipitation
  - a. Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
- 5. Wind
  - a. Do not spray coatings if wind velocity is above manufacturer's limit.

### B. Ventilation

- 1. Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D 102.

### C. Dust and Contaminants

- 1. Schedule coating work to avoid excessive dust and airborne contaminants.
- 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

## 1.7 TESTING EQUIPMENT

- A. The Contractor shall furnish and make available to the Engineer the following items of testing equipment for use in determining if requirements of this section are being satisfied. Specified items of equipment shall be available for the Engineer's use at all times when field painting or surface preparation is in progress.
- a. Wet film gauge.
  - b. Surface thermometer.
  - c. Keane-Tator surface profile comparator.
  - d. Set of National Association of Corrosion Engineers (NACE) visual standards.
  - e. Holiday (pin hole) detector (low voltage).
  - f. Sling-psychrometer.
  - g. Magnetic dry film gauge.

## 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Approved manufacturers include:

1. Tnemec.
2. Induron.
3. Carboline.

B. Unless otherwise indicated, product names and numbers specified herein are manufactured by Tnemec. Equivalent materials produced by approved Manufacturer's shall be acceptable subject to prior review by the Engineer.

### 2.2 PAINTING SCHEDULE

A. General: The Painting Schedule presented below summarizes the painting systems to be applied to the various surfaces.

B. Exposure terms refer to the environmental conditions to which different surfaces may be exposed. A surface may exist in more than one exposure, e.g. an exterior wall can be categorized not only as "Exposed", but also as "Buried", where the exposure is below the grade line.

C. In addition to the major items listed in the Painting Schedule, the Contractor shall paint safety warnings and notices as outlined in these specifications.

PAINTING SCHEDULE						
Exposure	System Type	Surface Prep	Prime Coat	Intermediate Coat	Finish Coat	Total DFT
CONCRETE FLOORS – interior concrete floor slabs						
Severe Chemical/ Functional	Epoxy	Grind Floor, SSPC-SP 13/NACE 6, followed by abrasive blast	Series 201 Epoxoprime, 6 to 12 mils DFT	Series 282 Tneme-Glaze, 6 to 12 mils DFT	Series 280 Tneme-Glaze, 6 to 12 mils DFT	18 to 36 mils
CONCRETE MASONRY UNITS						
Interior Exposed (interior walls exposed to view)	Epoxy	SSPC-SP 13/NACE 6, clean and dry	Tnemec Series 54-660 Masonry filler 75 to 100 sq ft/gal	Tnemec Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT	Tnemec Series N69 Hi-Build Epoxoline II, 4 to 6 mils DFT	8 to 12 mils
PVC						
Exterior Exposed	Epoxy/ Polyurethane	Scarify	Tnemec Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT		Tnemec Series 73 Endura-Shield 2 to 3 mils DFT	4 to 6 mils
Interior Exposed	Epoxy	Scarify	Tnemec Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT		Tnemec Series N69 Hi-Build Epoxoline II, 2 to 3 mils DFT	4 to 6 mils

### 2.3 COLORS

A. Building Walls and Floors: Match existing color

B. Chemical Piping: Selected by Owner from standard color chart

### 2.4 ACCESSORIES

A. Coating Application Accessories

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
2. Products of coating manufacturer.

### 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions under which coating systems are to be applied. Notify Engineer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

#### 3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

#### 3.3 SURFACE PREPARATION OF PVC

- A. Prepare PVC surfaces in accordance with Manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Scarify PVC surfaces.

#### 3.4 SURFACE PREPARATION OF CONCRETE FLOORS

- A. Prepare concrete surfaces in accordance with Manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Allow concrete to cure for a minimum of 28 days before coating.
- D. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

#### 3.5 SURFACE PREPARATION OF POROUS CONCRETE MASONRY UNITS

- A. Prepare porous concrete masonry unit surfaces in accordance with Manufacturer's instructions and SSPC-SP 13/NACE 6.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Allow mortar to cure for a minimum of 28 days before coating.
- D. Level protrusions and mortar spatter.

#### 3.6 APPLICATION

- A. Apply coatings in accordance with Manufacturer's instructions.
- B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- C. Keep containers closed when not in use to avoid contamination.
- D. Do not use mixed coatings beyond pot life limits.
- E. Use application equipment, tools, pressure settings, and techniques in accordance with Manufacturer's instructions.
- F. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

### 3.7 REPAIR

#### A. Materials and Surfaces Not Scheduled To Be Coated

1. Repair or replace damaged materials and surfaces not scheduled to be coated.

#### B. Damaged Coatings

1. Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

#### C. Coating Defects

1. Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

### 3.8 FIELD QUALITY CONTROL

#### A. Applicator's Services

1. Verify coatings and other materials are as specified.
2. Verify surface preparation and application is as specified.
3. Verify DFT of each coat and total DFT of each coating system is as specified using wet film and dry film gauges.
4. Coating Defects
  - a. Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
  - b. Check for holidays on interior steel immersion surfaces using holiday detector.
5. Report
  - a. Submit daily written reports describing work performed, inspections made, and actions taken to correct nonconforming work. Daily reports shall contain, but not be limited to, the following information:
    - 1) Start date and time of work in each area.
    - 2) Weather conditions.
    - 3) Date and time of application for each following coat.
    - 4) Moisture content of substrate prior to each coat.
    - 5) Provisions utilized to maintain temperature and humidity of work area with Manufacturer's recommended ranges.
  - b. Report nonconforming work not corrected.
  - c. Submit copies of report to Engineer and Contractor.

#### B. Manufacturer's Field Services

1. Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems and shall be available per paragraph 1.5.E.

### 3.9 CLEANING

- A. Remove temporary coverings and protection of surrounding areas and surfaces.

### 3.10 PROTECTION OF COATING SYSTEMS

- A. Protect surfaces of coating systems from damage during construction.

### 3.11 ONE-YEAR INSPECTION

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Engineer, and Manufacturer's

representative.

- C. Repair deficiencies in coating systems as determined by Engineer in accordance with Manufacturers instructions.

### 3.12 PIPE LABELS

- A. After painting of pipe work is completed, all pipe work shall have stenciled labels indicating the contents of the pipe (i.e. "FERROUS CHLORIDE").
- B. Labels shall be placed on each side of the pipe (180 degrees from each other) and spaced at maximum 20 feet on center. Labels shall be placed such that they are in direct line of sight. For pipe runs less than 20 feet, label shall be placed at the center of the run or the most visible location. Label may be omitted from one side of pipe if view is obstructed from that side.
- C. When the flow in a pipe is in one direction at all times, flow direction arrows shall be placed in front of each label on the pipe.
- D. The width of each letter shall be 80% of the height of each letter. The height of each letter shall be as follows:
  - 1. For pipes ¾" to 1½" in diameter: ½" in height.
  - 2. For pipes 2" in diameter: ¾" in height.
  - 3. For pipes 2½" to 6" in diameter: 1¼" in height.
  - 4. For pipes 6" to 10" in diameter: 2½" in height.
  - 5. For pipes greater than 10" in diameter: 3½" in height.
- E. For pipes smaller than ¾" in outside diameter, use a laminated plastic or aluminum tag with the lettering etched or stamped and filled in with black or contrasting enamel.
- F. Labels shall be black or white in color such that it is contrasting with the primary pipe color.

### 3.13 EQUIPMENT LABELS

- A. Where specified or directed by the Engineer, the Contractor shall label, in the same manner as the pipe, the individual units of equipment such as blowers, pumps, collector drives, compressors, silencers, etc. All push buttons, starters, switches, etc., when remote from the equipment, shall have labels of the engraved plastic type affixed to or adjacent to the remote switch, push button, starter, etc.

\*\* END OF SECTION \*\*

SECTION 22 05 29  
HANGERS AND SUPPORTS FOR PLUMBING AND EQUIPMENT

1 GENERAL

1.1 SCOPE OF WORK

- A. The work covered by this section includes providing all labor, materials, and equipment required to install pipe supports, hangers, and brackets necessary to support piping and piping accessories. The Contractor shall furnish and install all foundations, anchor bolts, pipe supports, shims, hangers, clamps, and hardware required for a complete installation as shown on the Drawings and/or specified herein.
- B. For clarity, not all pipe supports are shown on the drawings. All pipes shall be supported in accordance with these specifications. All valves and changes in pipe direction shall be supported by concrete pier or mechanical type pipe support.

1.2 SHOP DRAWINGS AND ENGINEERING DATA

- A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.

1.3 STORAGE AND PROTECTION

- A. Pipe supports and accessories shall be stored and protected in accordance with the requirements of Section 01 66 00, Product Storage and Handling Requirements.

1.4 WARRANTIES AND BONDS

- A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01 78 36, Warranties.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Approved manufacturers include:
  - 1. Champion Fiberglass, Spring, TX
  - 2. Seasafe, Inc., Lafayette, LA
  - 3. Or equal

2.2 PIPE SUPPORTS

- A. Pipe supports shall be fabricated from vinyl ester resin fiberglass strut and shapes with the following physical properties:
  - 1. Tensile Strength (Longitudinal): Minimum 35,000 PSI
  - 2. Tensile Strength (Transverse): Minimum 10,000 PSI
  - 3. Tensile Modulus (Longitudinal): Minimum  $3.0 \times 10^6$  PSI
  - 4. Tensile Modulus (Transverse): Minimum  $1.0 \times 10^6$  PSI
  - 5. Flexural Strength (Longitudinal): Minimum 35,000 PSI
  - 6. Flexural Strength (Transverse): Minimum 14,000 PSI
  - 7. Flexural Modulus (Longitudinal): Minimum  $2.0 \times 10^6$  PSI
  - 8. Flexural Modulus (Transverse): Minimum  $1.0 \times 10^6$  PSI
  - 9. Compressive Strength (Longitudinal): Minimum 35,000 PSI
  - 10. Compressive Strength (Transverse): Minimum 20,000 PSI
  - 11. Shear Strength (Longitudinal): Minimum 6,000 PSI

12. Shear Strength (Transverse): Minimum 5,500 PSI
  13. Impact Strength – Izod (Longitudinal): Minimum 30 ft-lbs/in
  14. Impact Strength – Izod (Transverse): Minimum 5 ft-lbs/in
  15. Flame Spread Rating: ASTM E84, Class 1
- B. All pipe support accessories including pipe straps, strut post base supports, etc. shall be manufactured from fiberglass reinforced vinyl ester.
- C. Support Racks
1. Support racks shall be fabricated from fiberglass strut and shapes.
  2. Required span of support rack shall be determined by contractor based on the requirements of the installation; however, minimum span shall be 13-inches.
  3. Support racks shall be capable of supporting a load of 750 pounds.
- D. All connecting hardware, nuts, bolts, washers, etc. shall be non-metallic manufactured from fiberglass reinforced polyurethane.
- E. All anchoring hardware for anchoring to concrete surfaces shall be titanium unless otherwise noted.
- F. All materials shall be corrosion resistant to sodium hypochlorite, ferrous chloride, and sodium bisulfite.
- G. All materials shall be UV resistant.
1. Fiberglass strut and shapes shall have a synthetic surfacing veil applied on exterior surfaces to protect against weather and inhibit ultraviolet degradation.
  2. Fiberglass products shall have ultraviolet stabilizers in the resin to inhibit ultraviolet degradation.

### 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install pipe supports in accordance with the Manufacturers requirements to produce a finished product that is clean and demonstrates true craftsmanship.
- B. Install the number of pipe supports at the specified minimum intervals and as required to properly support the pipe and pipe accessories.
- C. Fabricate pipe supports using FRP strut, FRP connector plates, and non-metallic connecting hardware.
- D. If fiberglass support materials are cut in the field, seal exposed fibers with fiberglass field cutting sealant.

\*\* END OF SECTION \*\*

SECTION 22 45 33  
COMBINATION EMERGENCY SHOWER AND EYEWASH

1 GENERAL

1.1 SCOPE OF WORK

- A. The work covered by this section includes furnishing all labor, materials, and equipment required to install, test, and place into satisfactory operation combination emergency shower and eyewashes and appurtenances as specified herein and as shown on the drawings.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications.
  - 1. Drawings showing plan, elevation, and appropriate cross sections of the equipment being provided.
  - 2. Complete engineering data including, but not limited to, descriptive data, material specifications, pump performance curves, motor performance data, piping diagrams, and wiring diagrams, as appropriate, to support the design of the equipment being provided.
  - 3. Printed warranty

1.3 OPERATION AND MAINTENANCE DATA

- A. The Contractor shall provide operation and maintenance data in accordance with the requirements of Section 01 78 23, Operation and Maintenance Data.

1.4 STORAGE AND PROTECTION

- A. Equipment shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

1.5 WARRANTIES AND BONDS

- A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01 78 36, Warranties.
- B. The equipment manufacturer shall provide a warranty against defective or deficient equipment, workmanship and materials under normal use, operation and service. The warranty shall be for one (1) year from the date of Engineer's acceptance of the work. The warranty shall be in printed form and apply to all similar units.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Approved manufacturers include:
  - 1. Bradley Corporation
  - 2. Guardian Equipment
  - 3. Haws Corporation

2.2 CONSTRUCTION

- A. Combination Emergency Shower and Eyewash (Indoor Location)
  - 1. Combination emergency shower and eyewashes located in indoor conditioned spaces shall be 1¼" IPS Schedule 40 hot-dipped galvanized steel pipe and fittings with a 9" diameter cast-iron floor flange. Pipe and flange shall be powder coated with epoxy

paint.

2. Stainless steel eyewash bowl with plastic pop-off dust cover for the eyewash head.
3. Stainless steel drench shower head with integral 20 GPM flow control.
4. Connection Size: 1¼" NPT
5. Chrome-plated brass, stay-open eyewash and shower ball valves with stainless steel ball and stem.
6. Stainless steel paddle for eyewash activation and stainless steel pull lever for shower activation.
7. Chrome-plated brass in-line 50x50 mesh water strainer.
8. Emergency Alarm System
  - a. Provide an alarm system that activates when the combination emergency shower and eyewash is turned on.
  - b. Emergency alarm system shall, at a minimum, have the following components:
    - 1) Flow switch with two (2) contacts rated for 120VAC, 5 Amp. One contact shall be used for flashing alarm light and second contact shall be used for alarm to plant SCADA system.
    - 2) Flashing light and alarm
    - 3) Electrical: 120VAC, 60 Hz
    - 4) Electrical Classification: NEMA 4X

B. Combination Emergency Shower and Eyewash (Outdoor Location)

1. Combination emergency shower and eyewashes located in outdoor locations and indoor unconditioned spaces shall be a freeze protected combination emergency shower and eyewash.
2. Combination emergency shower and eyewash shall be constructed of 1¼" IPS Schedule 40 hot-dipped galvanized steel pipe and fittings with a 9" diameter cast-iron floor flange. Pipe and flange shall be powder coated with epoxy paint.
3. Combination emergency shower and eyewash shall have a thermostatically controlled 120 VAC electric heat trace system. Heat trace cable shall be covered by minimum ¾" of insulation and an ABS plastic jacket that protects the unit down to an ambient temperature of -30°F.
4. Stainless steel eyewash bowl with plastic pop-off dust cover for the eyewash head.
5. Stainless steel drench shower head with integral 20 GPM flow control.
6. Connection Size: 1¼" NPT
7. Chrome-plated brass, stay-open eyewash and shower ball valves with stainless steel ball and stem.
8. Stainless steel paddle for eyewash activation and stainless steel pull lever for shower activation.
9. Chrome-plated brass in-line 50x50 mesh water strainer.
10. Automatic thermal actuator freeze protection bleed valve.
11. Emergency Alarm System
  - a. Provide an alarm system that activates when the combination emergency shower and eyewash is turned on.
  - b. Emergency alarm system shall, at a minimum, have the following components:
    - 1) Flow switch with two (2) contacts rated for 120VAC, 5 Amp. One contact shall be used for flashing alarm light and the second contact shall be used for alarm to plant SCADA system.

- 2) Flashing light and alarm
- 3) Electrical: 120VAC, 60 Hz
- 4) Electrical Classification: NEMA 4X

### 3 EXECUTION

#### 3.1 INSTALLATION

- A. Combination emergency shower and eyewashes shall be installed in accordance with the Manufacturer's requirements to produce a finished product that is clean and demonstrates true craftsmanship.
- B. Manufacturer shall allow for a minimum of one (1) trip to the project site to assist the contractor with the installation of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.

#### 3.2 STARTUP AND TESTING

- A. Combination emergency shower and eyewashes shall be field tested after installation to demonstrate proper operation to the satisfaction of the Engineer. Field tests shall be conducted by the Manufacturer or his Authorized Representative. All tests shall be performed in the presence of the Engineer. Test results shall be in printed form and signed by the Manufacturer or his Representative and supplied to the Owner.
- B. Manufacturer shall allow for a minimum of one (1) trip to the project site for startup and testing of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.
- C. Manufacturer shall provide services, as required, for the testing and startup requirements specified in Section 01 75 16, Testing and Startup.

#### 3.3 CERTIFICATION

- A. A manufacturer's representative that is qualified in the particular equipment requirements shall fully inspect and certify the equipment installation. Written certifications shall be provided that state the equipment is installed properly, is operating within the design parameters, and will be warranted as required by the specifications.

#### 3.4 TRAINING

- A. Provide operator training in accordance with Section 01 79 00, Demonstration and Training.

#### 3.5 ACCEPTANCE

- A. Acceptance of equipment will not be made until all equipment has been installed and tested, the manufacturer has certified the installation, the manufacturer has conducted the required training classes, final operation and maintenance manuals have been submitted to the engineer, and all spare parts have been turned over to the Owner.

\*\* END OF SECTION \*\*

SECTION 26 05 02  
BASIC ELECTRICAL REQUIREMENTS

1 GENERAL

1.1 SUMMARY

- A. Requirements specified within this section apply to Division 26, Electrical. Work specified herein shall be performed as if specified in the individual sections.
  
- B. Summary of work:
  - 1. Testing of all existing cable to verify acceptable condition for cable reuse.
  - 2. Conduit, wire, field connections and installation for all motors, motor controllers, control devices, control panels, and “packaged” equipment furnished under other Divisions of these Specifications.
  - 3. Installation, mounting and field wiring for all field-mounted devices and instruments, furnished under other Divisions of these Specifications, which require on-site electrical or electronic wiring supply / terminations. All conduit, wire, and interconnections between devices, primary elements, transmitters, indicators, sensors, switches, alarms, control panels, etc. Installation of all cables and equipment furnished by instrumentation and electronic system suppliers and process control system suppliers.
  - 4. Installation of all control panels, controllers, etc. furnished under other Divisions of these Specifications.
  - 5. Complete, functional, fully installed, interconnected and tested systems for power, control, lighting, grounding, telephone, data, etc. as indicated in other Sections of Division 26 – Electrical, and as shown on the Contract Drawings.
  - 6. Unless specified otherwise, Contractor shall review the Shop Drawings of all electrically operated equipment and equipment with electrical connections furnished under all divisions of these specifications. Contractor shall wire and interconnect all materials, devices, components, systems and packages requiring “field wiring”. Where applicable, Contractor shall make electrical interconnections per manufacturer s requirements. This includes, but is not limited to, devices that are parts of “packages” but which are shipped separately and require field connection. Also, Contractor shall identify terminals and prepare drawings or wiring tables to extent necessary to enable interconnections.
  - 7. Demolition, where required.

1.2 ACTION SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
  
- B. Provide Data For:
  - 1. Electrical service components.
  - 2. Telephone service components.
  - 3. Nameplates, signs, and labels.
  
- C. Provide preliminary submittal for sequence of construction 14 days in advance of coordination meeting. Preliminary submittal shall include items listed in special project requirements.

### 1.3 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
  - 1. National Electrical Contractors Association (NECA): National Electrical Installation Standards.
  - 2. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
    - b. Z535.4, Product Safety Signs and Labels.
  - 3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
  - 4. Underwriters Laboratories, Inc. (UL).

### 1.4 QUALITY ASSURANCE

- A. Provide the Work in accordance with NFPA 70. Where required by Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.
- B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark or label.
- C. Provide materials and equipment acceptable to AHJ for Class, Division, and Group of hazardous area indicated.

### 1.5 WARRANTIES AND BONDS

- A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01 78 36, Warranties.
- B. The equipment manufacturer shall provide a warranty against defective or deficient equipment, workmanship and materials under normal use, operation and service. Unless otherwise specified, the warranty shall be for one (1) year from the date of Engineer's acceptance of the work. The warranty shall be in printed form and apply to all similar units."

## 2 PRODUCTS

### 2.1 GENERAL

- A. 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.
- B. Material and equipment installed in heated and ventilated areas shall be capable of continuous operation at their specified ratings within an ambient temperature range of 40 degrees F to 104 degrees F.
- C. Materials and equipment installed outdoors shall be capable of continuous operation at their specified rating within the site ambient temperature range.

## 2.2 EQUIPMENT FINISH

- A. Manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with, light gray color finish as approved by Owner.

## 2.3 NAMEPLATES

- A. Material: Laminated plastic.
- B. Attachment Screws: Stainless steel.
- C. Color: White, engraved to a black core.
- D. Letter Height:
  - 1. Pushbuttons/Selector Switches: 1/8 inch.
  - 2. Other electrical equipment: 1/4 inch.

## 2.4 SIGNS AND LABELS

- A. Sign size, lettering, and color shall be in accordance with NEMA Z535.4.

# 3 EXECUTION

## 3.1 GENERAL

- A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer.
- B. Check approximate locations of light fixtures, switches, 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 fixed locations. In the event of conflicts, notify Engineer in writing.
- C. Install work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Keep openings in boxes and equipment closed during construction.
- E. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully perform 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 to original condition.

## 3.2 ANCHORING AND MOUNTING

- A. Equipment anchoring and mounting shall be in accordance with manufacturer's requirements.

### 3.3 COMBINING CIRCUITS INTO COMMON RACEWAY

- A. Homerun circuits shown on Drawings indicate functional wiring requirements for power and control circuits. Circuits may be combined into common raceways in accordance with the following requirements:
  - 1. Analog control circuits from devices in same general area to same destination.
    - a. No power or AC discrete control circuits shall be combined in same conduit with analog circuits.
    - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.
    - c. Analog circuits shall be continuous from source to destination. Do not add TJB, splice, or combine into a multi-pair cable without authorization of Engineer.
    - d. Raceways: shall be sized per General Circuit and Raceway Schedule and do not exceed 40 percent fill.
    - e. Changes shall be documented on Record Drawings.
  - 2. Discrete control circuits from devices in the same general area to the same destination.
    - a. No power or analog control circuits shall be combined in same conduit with discrete circuits.
    - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
    - c. Raceways shall be sized per the General Circuit and Raceway Schedule and do not exceed 40 percent fill.
    - d. Changes shall be documented on Record Drawings.
  - 3. Power circuits from loads in same general area to same source location (such as: panelboard, switchboard, low voltage motor control center).
    - a. Lighting Circuits: Combine no more than three circuits to a single raceway. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
    - b. Receptacle Circuits, 120-Volt Only: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
    - c. All Other Power Circuits: Do not combine power circuits without authorization of Engineer.

### 3.4 NAMEPLATES, SIGNS, AND LABELS

- A. Equipment Nameplates:
  - 1. Provide a nameplate to label electrical equipment including switchgear, switchboards, motor control centers, panelboards, motor starters, transformers, terminal junction boxes, disconnect switches, switches and control stations.
  - 2. Switchgear, motor control center, transformer, and terminal junction box nameplates shall include equipment designation.
  - 3. Disconnect switch, starter, and control station nameplates shall include name and number of equipment powered or controlled by that device.
  - 4. Switchboard and panelboard nameplates shall include equipment designation, service voltage, and phases.

### 3.5 LOAD BALANCE

- A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.

- B. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, and other equipment where balancing is required.
- C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

### 3.6 CLEANING AND TOUCHUP PAINTING

- A. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming. Includes all electrical gear and cabinets.
- B. Touchup Paint:
  - 1. Touchup scratches, scrapes and chips on exterior and interior surfaces of devices and equipment with finish matching type, color, and consistency and type of surface of original finish.
  - 2. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets requirements of Specification, and is acceptable to Engineer.

### 3.7 PROTECTION FOLLOWING INSTALLATION

- A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation and contact surfaces.
- B. When equipment intended for indoor installation is installed at Contractor's convenience in areas where subject to dampness, moisture, dirt or other adverse atmosphere until completion of construction, ensure adequate protection from these atmospheres is provided and acceptable to Engineer.

\*\* END OF SECTION \*\*

## SECTION 26 05 04

### BASIC ELECTRICAL MATERIALS and METHODS

#### 1 GENERAL

##### 1.1 SUMMARY

- A. This section includes basic materials and methods common to all sections of Division 26

##### 1.2 ACTION SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. Product Data For:
1. Control devices.
  2. Control relays.
  3. Circuit breakers.
  4. Fused switches.
  5. Nonfused switches.
  6. Timers.
  7. Fuses.
  8. Enclosures: Include enclosure data for products having enclosures.

##### 1.3 EXTRA MATERIALS

- A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:
1. Fuses, 0 to 600 Volts: Six of each type and each current rating installed.

##### 1.4 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
    - a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
    - b. A1011/A1011M, Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low Alloy with Improved Formability and Ultra-High Strength.
    - c. E814 Standard Test Method for Fire Tests of Penetration Firestop Systems.
  2. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 18, Standard for Shunt Power Capacitors.
  3. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
    - b. AB 1, Molded Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.
    - c. ICS 2 Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
    - d. ICS 5, Industrial Control and Systems: Control Circuit and Pilot Devices.

- e. KS 1 Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum)
- 4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
- 5. Underwriters Laboratories Inc. (UL):
  - a. 98, Standard for Enclosed and Dead-Front Switches.
  - b. 248, Standard for Low Voltage Fuses.
  - c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
  - d. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
  - e. 508, Standard for Industrial Control Equipment.
  - f. 943, Standard for Ground-Fault Circuit-Interrupters.
  - g. 1059, Standard for Terminal Blocks.
  - h. 1479, Standard for Fire Tests of Penetration Firestops.

## 1.5 WARRANTIES AND BONDS

- A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01 78 36, Warranties.
- B. The equipment manufacturer shall provide a warranty against defective or deficient equipment, workmanship and materials under normal use, operation and service. Unless otherwise specified, the warranty shall be for one (1) year from the date of Engineer's acceptance of the work. The warranty shall be in printed form and apply to all similar units.

## 2 PRODUCTS

### 2.1 MOLDED CASE CIRCUIT BREAKER THERMAL MAGNETIC, LOW VOLTAGE

- A. General:
  - 1. Type: Molded case.
  - 2. Trip Ratings: 15-800 amps.
  - 3. Voltage Ratings: 120, 240, 277, 480, and 600V ac.
  - 4. Suitable for mounting and operating in any position.
  - 5. NEMA AB 1 and UL 489.
- B. Operating Mechanism:
  - 1. Overcenter, trip-free, toggle type handle.
  - 2. Quick-make, quick-break action.
  - 3. Locking provisions for padlocking breaker in open position.
  - 4. ON/OFF and TRIPPED indicating positions of operating handle.
  - 5. Operating handle to assume a center position when tripped.
- C. Trip Mechanism:
  - 1. Individual permanent thermal and magnetic trip elements in each pole.
  - 2. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
  - 3. Two and three pole, common trip.
  - 4. Automatically opens all poles when overcurrent occurs on one pole.
  - 5. Test button on cover.
  - 6. Calibrated for 40 degrees C ambient, unless shown otherwise.
  - 7. Do not provide single-pole circuit breakers with handle ties where multi-pole circuit breakers are shown.
- D. Short Circuit Interrupting Ratings:

1. Equal to, or greater than, available fault current or interrupting rating shown.
  2. Equal to rating of existing equipment.
  3. Not less than the following RMS symmetrical currents for the indicated trip ratings:
    - a. Up to 100A, less than 250V ac: 14000 amps.
    - b. Up to 100A, 250-600V ac: 22,000 amps.
    - c. Over 100A: 65,000 amps.
  4. Series Connected Ratings: Do not apply series connected short circuit.
- E. Ground Fault Circuit Interrupter (GFCI): Where indicated, equip breaker as specified above with ground fault sensor and rated to trip on 5-mA ground fault within 0.025 second (UL 943, Class A sensitivity, for protection of personnel).
1. Ground fault sensor shall be rated same as circuit breaker.
  2. Push-to-test button.
- F. Equipment Ground Fault Interrupter (EGFI): Where indicated, equip breaker specified above with ground fault sensor and rated to trip on 30-mA ground fault (UL-listed for equipment ground fault protection).
- G. Magnetic Only Type Breakers: Where shown; instantaneous trip adjustment which simultaneously sets magnetic trip level of each individual pole continuously through a 3X to 10X trip range.
- H. Connections:
1. Supply (line side) at either end.
  2. Mechanical wire lugs, except crimp compression lugs where shown.
  3. Lugs removable/replaceable for breaker frames greater than 100 amperes.
  4. Suitable for 75 degrees C rated conductors without derating breaker or conductor ampacity.
  5. Use bolted bus connections, except where bolt-on is not compatible with existing breaker provisions.
- I. Enclosures for Independent Mounting:
1. See Article Enclosures.
  2. Service Entrance Use: Breakers in required enclosure and required accessories shall be UL 489 listed.
  3. Interlock: Enclosure and switch shall interlock to prevent opening cover with switch in the ON position. Provide bypass feature for use by qualified personnel.

## 2.2 DISCONNECT SWITCHES

- A. Disconnect Switches: UL-98 and NEMA KS-1; heavy duty, quick make, quick break type; horsepower and i2t rated. Provide lever type operating handle directly connected to the switch mechanism; rocker types are not acceptable. Include padlocking provisions and nameplate clearly indicating "ON" and "OFF" positions. Equip all switches with a ground lug and, where neutral conductors are scheduled, provide insulated neutral lugs.
- B. Fusible Switches: Equip with rejection clips for fuse types noted. Fuses shall be Class R, J, or L where required with 200,000A short circuit rating.
- C. Connections:
1. Mechanical lugs, except crimp compression lugs where shown.
  2. Lugs removable/replaceable.
  3. Suitable for 75 degrees C rated conductors at NEC 75 degrees C ampacity.

- D. Enclosures: Stainless steel meeting NEMA 4X and 12 requirements.
- E. Interlock: Enclosure and switch to prevent opening cover with switch in ON position. Provide bypass feature for use by qualified personnel.
- F. Acceptable Manufacturers: Cutler-Hammer, General Electric, Square D or Siemens.
- G. Hazardous Areas: Where Division 1 or 2 classified areas are indicated, provide switches equal to Crouse-Hinds type FLS.

### 2.3 FUSES

- A. Fuses: Current limiting, non-renewable type, rated 200,000 AIC, with rejection feature; Class J or as required by load for ratings 600 amp and below and Class L for ratings 601 amp and above.
- B. Acceptable Manufacturers: Bussmann, Chase-Shawmut, or Littelfuse.

### 2.4 WIRING DEVICES

- A. Wall Switches: NEMA WD 1; FS W S 896; 20 amp, 120/277 volt, specification grade; horsepower rated; quiet type; back and side wiring provisions; toggle handle.
- B. Convenience Receptacles: NEMA WD 1; FS W C 596; 15 amp, 125 volt, specification grade; impact resistant nylon face; back and side wiring provisions; grounding screw. Where CR or NEMA 4X is indicated, provide corrosion resistant receptacle, yellow nylon body, one-piece brass contacts. Exception: Provide 5-20R receptacles for branch circuits serving one device.
- C. Specific Use Receptacles: NEMA WD 1 or WD 5; type as indicated. For branch circuits serving a single device, match device rating to branch circuit rating.
- D. Receptacle, Ground Fault Interrupter: Duplex, specification grade, tripping at 5-milliamps; 125-volt, configuration 5-20R.
- E. Device Colors: Gray, unless otherwise selected by the Owner for specific use devices.
- F. Indoor Device Plates: Type 302 stainless steel, 0.030 inch thick minimum, satin finish.
- G. Indoor Corrosion Resistant (NEMA 4X) Cover Plates: Type 302 stainless steel, specification grade, gasketed, with silicone rubber mat, equal to Pass & Seymour 4515 or 4515FS for toggle switches. Cast aluminum, gasketed, equal to Pass & Seymour CA Series receptacles. For devices which are continuously plugged in, provide cast aluminum, suitable for wet locations while-in-use, equal to Hubbell WP26.
- H. Outdoor Weatherproof (NEMA 3R and NEMA 4X) Cover Plates: Stainless steel, specification grade, gasketed equal to Sierra WP Series. For heat tape, instruments, or other devices which are continuously plugged in, provide die cast aluminum, suitable for wet locations while in use, equal to Hubbell WP26.

## 2.5 INDIVIDUAL MOTOR STARTERS

- A. Manual Starters: NEMA ICS-2; general purpose type; trip-free mechanism; with overload relays. Provide pushbutton operation for integral horsepower sizes, and toggle switch or lever for fractional sizes.
- B. Magnetic Starters: NEMA ICS-2; NEMA size 1 minimum; magnetically held contactor with field replaceable coil and contacts; bimetallic or melting alloy overload relay, manually reset. Starter shall be rated in accordance with NEMA size designations; fractional sizes and ratings per IEC recommendations are not acceptable.
- C. Magnetic Starter Controls: All controls are 120 volts. Equip each starter with a control power transformer fused on the primary and secondary. Provide starter overload relay auxiliary contacts for red run light, green stop light and amber overload light on the enclosure door. Provide one spare normally open starter auxiliary contact, and door mounted start-stop pushbuttons or hand-off-auto selector switch as indicated.
- D. Combination Starters: Molded case circuit breaker rated 22,000 AIC as a minimum.
- E. Enclosure: Stainless steel meeting NEMA 4X and 12 requirements.
- F. Acceptable Manufacturers: Allen-Bradley, Cutler-Hammer, General Electric, Siemens or Square D.
- G. Hazardous Areas: Where Division 1 or 2 classified areas are indicated, provide starters equal to Crouse-Hinds types EPC, EMG, EMN, or EFS/EFD.

## 2.6 CONTACTORS

- A. Control Relays: NEMA A600; heavy duty, machine tool type convertible contacts; electrically held 120 volt coil. Equal to Allen-Bradley Bulletin 700 Type P.
- B. General Purpose Contactors: NEMA ICS-2; electrically held; 2-wire control; 120 volt coil. Size and number of contacts as indicated.
- C. Lighting Contactors: NEMA ICS-2; mechanically held; 3 wire control; 120 volt coil. Size and number of contacts as indicated.
- D. Enclosure: NEMA ICS-6; Type 1 unless otherwise noted.
- E. Acceptable Manufacturers: General Electric, Square D, ASCO, or Cutler-Hammer.

## 2.7 CONTROL STATIONS

- A. Pushbuttons, Selectors and Pilot Lights: 600 volt, heavy duty, factory sealed.
- B. Enclosure: Stainless steel meeting NEMA 4X and NEC Class I, Division 2, Group C and D requirements.
- C. Acceptable Manufacturers: Equal to Allen-Bradley Bulletin 800T.
- D. Hazardous Areas: Where Division 1 classified areas are indicated, provide control stations equal to Crouse-Hinds EFS/EFD series.

## 2.8 SUPPORT AND FRAMING CHANNELS

- A. Carbon Steel Framing Channel:
  - 1. Material: Rolled, mild strip steel, 12-gauge minimum, ASTM A1011/A1011M, Grade 33.
  - 2. Finish: Hot-dip galvanized after fabrication.
- B. Paint Coated Framing Channel: Carbon steel framing channel with electro-deposited rust inhibiting acrylic or epoxy paint.
- C. PVC Coated Framing Channel: Carbon steel framing channel with 40-mil polyvinyl chloride coating.
- D. Stainless Steel Framing Channel: Rolled, ASTM A167, Type 316 stainless steel, 12-gauge minimum.
- E. Extruded Aluminum Framing Channel:
  - 1. Material: Extruded from Type 6063-T6 aluminum alloy.
  - 2. Fittings fabricated from Alloy 5052-H32.
- F. Nonmetallic Framing Channel:
  - 1. Material: Fire retardant, fiber reinforced vinyl ester resin.
  - 2. Channel fitting of same material as channel.
  - 3. Nuts and bolts of long glass fiber reinforced polyurethane.
- G. Manufacturers:
  - 1. B-Line Systems, Inc.
  - 2. Unistrut Corp.
  - 3. Aickinstrut.

## 2.9 ENCLOSURES

- A. Finish: Sheet metal structural and enclosure parts shall be completely painted using an electrode position process so interior and exterior surfaces as well as bolted structural joints have a complete finish coat on and between them.
- B. Color: Manufacturer's standard color (gray) baked-on enamel, unless otherwise shown.
- C. Barriers: Provide metal barriers within enclosures to separate wiring of different systems and voltage.

## 3 EXECUTION

### 3.1 GENERAL

- A. Install equipment in accordance with manufacturer's recommendations.

### 3.2 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

- A. Unless otherwise shown, install heavy-duty, oil-tight type in nonhazardous, indoor, dry locations, including motor control centers, control panels, and individual stations.

- B. Unless otherwise shown, install heavy-duty, watertight and corrosion-resistant type in nonhazardous, outdoor, or normally wet areas.

### 3.3 SUPPORT AND FRAMING CHANNEL

- A. Install where required for mounting and supporting electrical equipment, raceway, and cable tray systems.
- B. Channel Type:
  - 1. Interior, Wet or Dry (Noncorrosive) Locations:
    - a. Aluminum Raceway: Extruded aluminum.
    - b. PVC-Coated Conduit: PVC coated.
    - c. Steel Raceway and Other Systems Not Covered: Carbon steel or paint coated.
  - 2. Interior, Corrosive (Wet or Dry) Locations:
    - a. Aluminum Raceway: Extruded aluminum.
    - b. PVC Conduit: Type 316 stainless steel or nonmetallic.
    - c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel, nonmetallic, or PVC-coated steel.
  - 3. Outdoor, Noncorrosive Locations:
    - a. Steel Raceway: Carbon steel or paint coated framing channel, except where mounted on aluminum handrail, then use aluminum framing channel.
    - b. Aluminum Raceway and Other Systems Not Covered: Aluminum framing channel.
  - 4. Outdoor Corrosive Locations:
    - a. PVC Conduit: Type 316 stainless steel or nonmetallic.
    - b. Aluminum Raceway: Aluminum.
    - c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel, nonmetallic, or PVC coated steel.
- C. Paint cut ends prior to installation with the following:
  - 1. Carbon Steel Channel: Zinc-rich primer.
  - 2. Painted Channel: Rust-inhibiting epoxy or acrylic paint.
  - 3. Nonmetallic Channel: Epoxy resin sealer.
  - 4. PVC-Coated Channel: PVC patch.

\*\* END OF SECTION \*\*

## SECTION 26 05 05

### CONDUCTORS

#### 1 GENERAL

##### 1.1 SUMMARY

- A. This section includes all cables and conductors to be used for the connection of equipment covered under section 26.

##### 1.2 ACTION SUBMITTALS

- A. Wire and cable descriptive product information.
- B. Wire and cable accessories descriptive product information.
- C. Cable Pulling Calculations:
  - 1. Calculations shall be submitted and reviewed before cable installation.
  - 2. Provide cable pulling calculations for the following cable installations: Medium voltage cable runs that cannot be hand pulled.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Factory Test Report for conductors 600 volts and below.

##### 1.4 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
  - 1. ASTM International (ASTM):
    - a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
    - b. B3, Standard Specification for Soft or Annealed Copper Wire.
    - c. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
    - d. B496, Standard Specification for Compact Round Concentric Lay-Stranded Copper Conductors.
  - 2. Electronic Industries Alliance (EIA), Telecommunications Industry Association (TIA): TIA-568-B, Commercial Building Telecommunications Cabling Standard.
  - 3. Insulated Cable Engineer's Association, Inc. (ICEA):
    - a. S-58-679, Standard for Control Cable Conductor Identification.
    - b. S-73-532, Standard for Control Cables.
    - c. T-29-520, Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input of 210,000 Btu/hour.
  - 4. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. 386, Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
  - 5. National Electrical Manufacturers' Association (NEMA):
    - a. CC 1, Electric Power Connectors for Substations.

- b. WC 57, Standard for Control, Thermocouple Extension, and Instrumentation Cables - ICEA S-73-532.
- c. WC 70, Standard for Nonshielded Power Cables Rated 2,000 Volts or Less for the Distribution of Electrical Energy.
- d. WC 71, Standard for Nonshielded Cables Rated 2,001-5,000 Volts for Use in the Distribution of Electric Energy.
- e. WC 74, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
- 6. National Fire Protection Association (NFPA):
  - a. 70, National Electrical Code (NEC).
  - b. 262, Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- 7. Underwriters Laboratories Inc. (UL):
  - a. 13, Standard for Safety Power-Limited Circuit Cables.
  - b. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
  - c. 62, Standard for Safety Flexible Cord and Cables.
  - d. 486A-486B, Wire Connectors.
  - e. 486C, Standard for Splicing Wire Connections.
  - f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
  - g. 854, Standard for Safety Service-Entrance Cables.
  - h. 1072, Standard for Safety Medium-Voltage Power Cables.
  - i. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
  - j. 1569, Metal Clad Cables.
  - k. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.

## 1.5 QUALITY ASSURANCE

- A. Authority Having Jurisdiction (AHJ):
  - 1. Provide the Work in accordance with NFPA 70. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
  - 2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark.

## 2 PRODUCTS

### 2.1 CONDUCTORS 600V AND BELOW

- A. Conform to applicable requirements of NEMA WC 70.
- B. Conductor Type:
  - 1. 120-Volt and 277-Volt Lighting, 10 AWG and Smaller: Solid copper.
  - 2. 120-Volt Receptacle Circuits, 10 AWG and Smaller: Solid copper.
  - 3. All Other Circuits: Stranded copper
- C. Insulation: Type THHN/THWN-2, except for sizes No. 6 and larger, with XHHW-2 insulation.

- D. Flexible Cords and Cables:
  1. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
  2. Conform to physical and minimum thickness requirements of NEMA WC 70.

2.2 600V RATED CABLE

- A. General:
  1. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 70,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
  2. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
  3. Suitable for installation in open air, in cable trays, or conduit.
  4. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
  5. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant
- B. Type 1, Multiconductor Control Cable:
  1. Conductors:
    - a. 14 AWG, seven-strand copper.
    - b. Insulation: 15-mil PVC with 4-mil nylon.
    - c. UL 1581 listed as Type THHN/THWN rated VW-1.
    - d. Conductor group bound with spiral wrap of barrier tape.
    - e. Color Code: In accordance with ICEA S-58-679, Method 1, Table 2.
  2. Cable: Passes the ICEA T-29-520 210,000 Btu per hour Vertical Tray Flame Test.
  3. Cable Sizes:

No. Of Conductors	Max Outside Diameter (in)	Jacket Thickness (Mils)
3	0.41	45
5	0.48	45
7	0.52	45
1	0.72	60
9	0.83	60
25	1.00	60
37	1.15	80

- 4. Manufacturers:
  - a. Okonite Co.
  - b. Southwire
- C. Type 2, Multiconductor Power Cable:
  1. General:
    - a. Meet or exceed UL 1581 for cable tray use.
    - b. Meet or exceed UL 1277 for direct burial and sunlight-resistance.
    - c. Overall jacket: PVC.
  2. Conductors:
    - a. Class B stranded, coated copper.
    - b. Insulation: Chemically cross-linked ethylene-propylene or crosslinked polyethylene.
    - c. UL rated VW-1 or listed Type XHHW-2.
    - d. Color Code:
      - 1) Conductors, size 8 AWG and smaller, colored conductors, ICEA S-58-679, Method 1, Table 1.
      - 2) Conductors, size 6 AWG and larger, ICEA S-73-532, Method 4.
  3. Cable shall pass ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
  4. Cable Sizes:

Conductor Size	Minimum Ground Wire Size	No. Of Current Carrying Conductors	Max. Outside Diameter (in)	Nominal Jacket Thickness (Mils)
12	12	2	0.42	45
		3	0.45	45
		4	0.49	45
10	10	2	0.54	60
		3	0.58	60
		4	0.63	60
8	10	3	0.66	60
		4	0.75	60
6	8	3	0.74	60
		4	0.88	60
4	6	3	0.88	60
		4	1.04	80
2	6	3	1.01	80
		4	1.16	80
1	6	3	1.10	80
		4	1.25	80
1/0	6	3	1.22	80
		4	1.35	80
2/0	4	3	1.32	80
		4	1.53	80
3/0	4	3	1.40	80
		4	1.60	80
4/0	4	3	1.56	80
		4	1.78	110

5. Manufacturers:

- a. Okonite Co.
- b. Southwire

D. Type 3, 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.

- 1. Outer Jacket: 45-mil nominal thickness.
- 2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
- 3. Dimension: 0.31-inch nominal OD.
- 4. Conductors:
  - a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
  - b. 20 AWG, seven-strand tinned copper drain wire.
  - c. Insulation: 15-mil nominal PVC.

- d. Jacket: 4-mil nominal nylon.
- e. Color Code: Pair conductors, black and red.
- 5. Manufacturers:
  - a. Okonite Co.
  - b. Alpha Wire Corp.
  - c. Belden.
  
- E. Type 4, 16 AWG, Twisted, Shielded Triad Instrumentation Cable: Single triad, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.
  - 1. Outer Jacket: 45-mil nominal.
  - 2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer, overlapped to provide 100 percent coverage.
  - 3. Dimension: 0.32-inch nominal OD.
  - 4. Conductors:
    - a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    - b. 20 AWG, seven-strand, tinned copper drain wire.
    - c. Insulation: 15-mil nominal PVC.
    - d. Jacket: 4-mil nylon.
    - e. Color Code: Triad conductors black, red, and blue.
  - 5. Manufacturers:
    - a. Okonite Co.
    - b. Alpha Wire Corp.
    - c. Belden.
  
- F. Type 5, 18 AWG, Multi-Twisted, Shielded Pairs with a Common, Overall Shield Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable, meeting NEMA WC 57 requirements.
  - 1. Conductors:
    - a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8.
    - b. Tinned copper drain wires.
    - c. Pair drain wire size AWG 20, group drain wire size AWG 18.
    - d. Insulation: 15-mil PVC.
    - e. Jacket: 4-mil nylon.
    - f. Color Code: Pair conductors, black and red with red conductor numerically printed for group identification.
    - g. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer.
  - 2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.
  - 3. Cable Sizes:

Number of Pairs	Max. Outside Diameter (in)	Nominal Jacket Thickness (Mils)
4	0.50	45
8	0.68	60
12	0.82	60
16	0.95	80
24	1.16	80
36	1.33	80
50	1.56	80

- 4. Manufacturers
  - a. Okonite Co.

- b. Alpha Wire Co.
  - c. Belden
- G. Type 8, Multi-Conductor Adjustable Frequency Drive (AFD and VFD) Power Cable:
1. Conductors:
    - a. Class B, stranded coated copper.
    - b. Insulation: 600-volt cross-linked polyethylene, UL Type XHHW-2.
    - c. Grounding Conductors: Insulated stranded copper.
  2. Sheath:
    - a. UL 1277 Type TC, 90 degrees C.
    - b. Continuous shield, A1/polyester foil, drain wires, overall copper braid.
  3. Outer Jacket: Polyvinyl chloride (PVC) per UL 1569.
  4. Cable Sizes:

Conductor Size (AWG)	Minimum Ground Wire size (AWG)	No. Of Insulated Conductors	Max Outside Diameter (in)	Jacket Thickness (Mils)
12	12	4	0.610	50
10	10	4	0.670	50
8	8	4	0.910	50
6	6	4	1.010	50
4	4	4	1.150	50
2	2	4	1.310	50

5. Manufacturers and Products:
  - a. Belden, Series 29500.
  - b. Alpha Wire, Series V.
  - c. LAPP USA, OLFLEX VFD Slim.

### 2.3 SPECIAL CABLES

- A. Type 30, Unshielded Twisted Pair (UTP) Telephone and Data Cable, 300V:
1. Category 6 UTP, UL listed, and third party verified to comply with TIA/EIA 568-B.2-1 Category 6 requirements.
  2. Suitable for high speed network applications including gigabit ethernet and video. Cable shall be interoperable with other standards compliant products and shall be backward compatible with Category 5 and Category 5e.
  3. Provide four each individually twisted pair, 23 AWG conductors, with FEP insulation and blue PVC jacket.
  4. NFPA 70 Plenum (CMP) rated, comply with flammability plenum requirements of NFPA 70 and NFPA 262.
  5. Cable shall withstand a bend radius of 1-inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking.
  6. Manufacturer and Product: Belden; 7852A.
- B. Type 31, Data Highway Cable, Allen-Bradley "Blue Hose."
1. Meet or exceed electrical characteristics of Allen-Bradley Catalog No. 1770-CD.
  2. Approved by Allen-Bradley for use with A-B programmable logic controller systems.
  3. Outer Jacket: Blue PVC.
  4. Shield: 1.35-mil, double-faced aluminum/synthetic polymer, overlapped to provide 100 percent coverage.
  5. Drain: 55 percent tinned copper braid and drain wire.
  6. Dimension: 0.243-inch nominal OD.
  7. Conductors:
    - a. One pair #20 AWG, seven-strand tinned copper.

- b. Insulation: Polyethylene.
    - c. Color Code: Blue and clear.
  - 8. Manufacturers:
    - a. Allen-Bradley.
    - b. Belden.
- C. Type 32, DeviceNet Round Cable, 600V, Class 1, Two Twisted, Shielded Pairs with a Common Overall Shield:
  - 1. Outer Jacket: PVC.
  - 2. Overall Shield: Tinned copper braid, 18 AWG tinned copper drain wire.
  - 3. Individual Pair Shield: Aluminum foil-polyester tape.
  - 4. Dimension: 0.460-inch nominal OD.
  - 5. Conductors:
    - a. 15 AWG stranded tinned copper.
    - b. Insulation: FEP.
  - 6. Manufacturer and Product: Belden; 7897A.
- D. Type 33, DeviceNet Flat Cable, 600V, Class 1, Four Conductor Unshielded Network Trunk Cable:
  - 1. Outer Jacket: Thermoplastic Elastomer (TPE).
  - 2. Conductors: Four conductor, unshielded, flat configuration.
  - 3. Manufacturer and Product: Allen-Bradley; 1485C-P1E.

## 2.4 GROUNDING CONDUCTORS

- A. Equipment: Stranded copper with green, Type USE/RHH/RHW-XLPE or THHN/THWN, insulation.
- B. Direct Buried: Bare stranded copper.

## 2.5 ACCESSORIES FOR CONDUCTORS 600 VOLTS AND BELOW

- A. Tape:
  - 1. General Purpose, Flame Retardant: 7-mil, vinyl plastic, Scotch Brand 33+, rated for 90 degrees C minimum, meeting requirements of UL 510.
  - 2. Flame Retardant, Cold and Weather Resistant: 8.5-mil, vinyl plastic, Scotch Brand 88.
  - 3. Arc and Fireproofing:
    - a. 30-mil, elastomer.
    - b. Manufacturers and Products:
      - 1) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
      - 2) Plymouth; 53 Plyarc, with 77 Plyglas glass cloth tapebinder.
- B. Identification Devices:
  - 1. Sleeve:
    - a. Permanent, PVC, yellow or white, with legible machine-printed black markings.
    - b. Manufacturers and Products:
      - 1) Raychem; Type D-SCE or ZH-SCE.
      - 2) Brady, Type 3PS.
  - 2. Heat Bond Marker:
    - a. Transparent thermoplastic heat bonding film with acrylic pressure sensitive adhesive.
    - b. Self-laminating protective shield over text.
    - c. Machine printed black text.

- d. Manufacturer and Product: 3M Co.; Type SCS-HB.
  - 3. Marker Plate: Nylon, with legible designations permanently hot stamped on plate.
  - 4. Tie-On Cable Marker Tags:
    - a. Chemical-resistant white tag.
    - b. Size: 1/2 inch by 2 inches.
    - c. Manufacturer and Product: Raychem; Type CM-SCE.
  - 5. Grounding Conductor: Permanent green heat-shrink sleeve, 2-inch minimum.
- C. Connectors and Terminations:
- 1. Nylon, Self-Insulated Crimp Connectors:
    - a. Manufacturers and Products:
      - 1) Thomas & Betts; Sta-Kon.
      - 2) Burndy; Insulug.
      - 3) ILSCO: ILSCONS.
  - 2. Nylon, Self-Insulated, Crimp Locking-Fork, Torque-Type Terminator:
    - a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
    - b. Seamless.
    - c. Manufacturers and Products:
      - 1) Thomas & Betts; Sta-Kon.
      - 2) Burndy; Insulink.
      - 3) ILSCO; ILSCONS.
  - 3. Self-Insulated, Freespring Wire Connector (Wire Nuts):
    - a. UL 486C.
    - b. Plated steel, square wire springs.
    - c. Manufacturers and Products:
      - 1) Thomas & Betts.
      - 2) Ideal; Twister.
  - 4. Self-Insulated, Set Screw Wire Connector:
    - a. Two piece compression type with set screw in brass barrel.
    - b. Insulated by insulator cap screwed over brass barrel.
    - c. Manufacturers:
      - 1) 3M Co.
      - 2) Thomas & Betts.
      - 3) Marrette.
- D. Cable Lugs:
- 1. In accordance with NEMA CC 1.
  - 2. Rated 600 volts of same material as conductor metal.
  - 3. Uninsulated Crimp Connectors and Terminators:
    - a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
    - b. Manufacturers and Products:
      - 1) Thomas & Betts; Color-Keyed.
      - 2) Burndy, Hydent.
      - 3) ILSCO: PDB.
  - 4. Uninsulated, Bolted, Two-Way Connectors and Terminators:
    - a. Manufacturers and Products:
      - 1) Thomas & Betts; Locktite.
      - 2) Burndy; Quiklug.
      - 3) ILSCO: PBTD.
- E. Cable Ties:
- 1. Nylon, adjustable, self-locking, and reusable.
  - 2. Manufacturer and Product: Thomas & Betts; TY-RAP.
- F. Heat Shrinkable Insulation:
- 1. Thermally stabilized cross-linked polyolefin.

2. Single wall for insulation and strain relief.
  3. Dual Wall, adhesive sealant lined, for sealing and corrosion resistance.
  4. Manufacturers and Products:
    - a. Thomas & Betts; SHRINK-KON.
    - b. Raychem; RNF-100 and ES-2000.
- G. Data Cable Accessories: Terminators, connectors, and junctions necessary for a complete DeviceNet system.

## 2.6 PULLING COMPOUND

- A. Nontoxic, noncorrosive, noncombustible, nonflammable, water-based lubricant; UL listed.
- B. Suitable for rubber, neoprene, PVC, polyethylene, hypalon, CPE, and lead-covered wire and cable.
- C. Approved for intended use by cable manufacturer.
- D. Suitable for zinc-coated steel, aluminum, PVC, bituminized fiber, and fiberglass raceways.
- E. Manufacturers:
  1. Ideal Co.
  2. Polywater, Inc.
  3. Cable Grip Co.

## 2.7 WARNING TAPE

- A. As specified in Section 26 05 33, Raceways and Boxes.

## 2.8 SOURCE QUALITY CONTROL

- A. Conductors 600 Volts and Below: Test in accordance with UL 44 and UL 854.

# 3 EXECUTION

## 3.1 GENERAL

- A. Conductor installation shall be in accordance with manufacturer's recommendations.
- B. Conductor and cable sizing shown is based on copper conductors, unless noted otherwise.
- C. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii.
- D. Terminate all conductors and cables, unless otherwise indicated.
- E. Tighten screws and terminal bolts in accordance with UL 486A-486B for copper conductors.

- F. Cable Lugs: Provide with correct number of holes, bolt size, and center-to-center spacing as required by equipment terminals.
- G. Bundling: Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 18 inches on center.
- H. Ream, remove burrs, and clear interior of installed conduit before pulling wires or cables.
- I. Concrete-Encased Raceway Installation: Prior to installation of conductors, pull through each raceway a mandrel approximately 1/4 inch smaller than raceway inside diameter.

3.2 POWER CONDUCTOR COLOR CODING

- A. Conductors 600 Volts and Below:
  - 1. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1-1/2 inches to 2 inches wide.
  - 2. 8 AWG and Smaller: Provide colored conductors.
  - 3. Colors:

System	Conductor	Color
All Systems	Equipment Grounding	Green
240/120v 1Ph, 3W	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208/120v 3Ph, 4W	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120v 3Ph, 4W Delta, Center Tap Ground on 1Ph	Grounded Neutral Phase A High (Wild) Leg Phase C	White Black Orange Blue
240/120v 1Ph, 3W	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
480/277v 3Ph, 4W	Grounded Neutral Phase A Phase B Phase C	White Brown Orange Yellow
NOTE: Phase A, B, C implies direction of positive Phase Rotation		

- 4. Tracer: Outer covering of white with an identifiable colored strip, other than green, in accordance with NFPA 70.

3.3 CIRCUIT IDENTIFICATION

- A. Identify power, instrumentation, and control conductor circuits at each termination, and in accessible locations such as manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.
- B. Circuits Not Appearing in Circuit Schedules:

1. Assign circuit name based on device or equipment at load end of circuit.
  2. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.
- C. Method:
1. Conductors 3 AWG and Smaller: Identify with sleeves or heat bond markers.
  2. Cables and Conductors 2 AWG and Larger:
    - a. Identify with marker plates or tie-on cable marker tags.
    - b. Attach with nylon tie cord.
  3. Taped-on markers or tags relying on adhesives not permitted.

### 3.4 WIRING IDENTIFICATION:

- A. In addition to color coding, all wiring shall be identified at each point of termination. This includes but is not limited to identification at the source, load, and in any intermediate junction boxes where a termination is made. The Contractor shall meet with the Owner and Engineer to come to an agreement regarding a wire identification system prior to installation of any wiring. Wire numbers shall not be duplicated.
- B. Wire identification shall be by means of a heat shrinkable sleeve. Sleeves shall have a white background with black text. Wire sizes #14 AWG through #10 AWG shall have a minimum text size of 7 points. Wire sizes #8 AWG and larger shall have a minimum text size of 10 points. Sleeves shall be of appropriate length to fit the required text. The use of handwritten text for wire identification shall not be permitted.
- C. Sleeves shall be suitable for the size of wire on which they are installed. When installation is complete, sleeves shall be tightly affixed to the wire and shall not move. Sleeves shall be heat shrunk onto wiring with a heat gun approved for the application. Sleeves shall not be heated by any means which employs the use of an open flame. The Contractor shall take special care to ensure that the wiring insulation is not damaged during the heating process.
- D. Sleeves shall be installed prior to the completion of the wiring terminations and shall be oriented so that they can be easily read.
- E. Sleeves shall be white polyolefin as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal.
- F. Where sleeves are not available in the size required for the wire, the Contractor shall use an adhesive label with a white background and black text. Text size shall be in accordance with the requirements listed above.
- G. Adhesive labels, for the case when sleeves are not suitable for the wire size, shall be white permanent vinyl as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal.
- H. Wire identification in manholes, handholes, pull boxes, and other accessible components in the raceway system where the wiring is continuous shall be accomplished by means of a tag installed around the bundled group of conductors. Identification shall utilize a FROM-TO system. Each group of conductors shall consist of all of the individual conductors in a single conduit or duct. The tag shall have text that identifies the bundle in accordance with the 'FROM' and 'TO' column for that particular conduit number in the conduit and wire schedule. Minimum text size shall be 10 point. The tag shall be affixed to the wire bundle by the use of nylon wire ties, and shall be made of polyethylene as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal.

### 3.5 CONDUCTORS 600 VOLTS AND BELOW

- A. Install 10 AWG or 12 AWG conductors for branch circuit power wiring in lighting and receptacle circuits.
- B. Do not splice incoming service conductors and branch power distribution conductors 6 AWG and larger, unless specifically indicated or approved by Engineer.
- C. Connections and Terminations:
  - 1. Install wire nuts only on solid conductors. Wire nuts are not allowed on stranded conductors.
  - 2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control, circuit conductors.
  - 3. Install self-insulated, set screw wire connectors for two-way connection of power circuit conductors 12 AWG and smaller.
  - 4. Install uninsulated crimp connectors and terminators for instrumentation, control, and power circuit conductors 4 AWG through 2/0 AWG.
  - 5. Install uninsulated, bolted, two-way connectors and terminators for power circuit conductors 3/0 AWG and larger.
  - 6. Install uninsulated terminators bolted together on motor circuit conductors 10 AWG and larger.
  - 7. Place no more than one conductor in any single-barrel pressure connection.
  - 8. Install crimp connectors with tools approved by connector manufacturer.
  - 9. Install terminals and connectors acceptable for type of material used.
  - 10. Compression Lugs:
    - a. Attach with a tool specifically designed for purpose. Tool shall provide complete, controlled crimp and shall not release until crimp is complete.
    - b. Do not use plier type crimpers.
- D. Do not use soldered mechanical joints.
- E. Splices and Terminations:
  - 1. Insulate all uninsulated connections.
  - 2. Indoors: Use general purpose, flame retardant tape or single wall heat shrink.
  - 3. Outdoors, Dry Locations: Use flame retardant, cold- and weather resistant tape or single wall heat shrink.
  - 4. Below Grade and Wet or Damp Locations: Use dual wall heat shrink.
- F. Cap spare conductors with UL listed end caps.
- G. Wiring Identification:
  - 1. In addition to color coding, all wiring shall be identified at each point of termination. This includes but is not limited to identification at the source, load, and in any intermediate junction boxes where a termination is made. The Contractor shall meet with the Owner and Engineer to come to an agreement regarding a wire identification system prior to installation of any wiring. Wire numbers shall not be duplicated.
  - 2. Wire identification shall be by means of a heat shrinkable sleeve. Sleeves shall have a white background with black text. Wire sizes #14 AWG through #10 AWG shall have a minimum text size of 7 points. Wire sizes #8 AWG and larger shall have a minimum text size of 10 points. Sleeves shall be of appropriate length to fit the required text. The use of handwritten text for wire identification shall not be permitted.
  - 3. Sleeves shall be suitable for the size of wire on which they are installed. When installation is complete, sleeves shall be tightly affixed to the wire and shall not move. Sleeves shall be heat shrunk onto wiring with a heat gun approved for the application.

Sleeves shall not be heated by any means which employs the use of an open flame. The Contractor shall take special care to ensure that the wiring insulation is not damaged during the heating process.

4. Sleeves shall be installed prior to the completion of the wiring terminations and shall be oriented so that they can be easily read.
  5. Sleeves shall be white polyolefin as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal.
  6. Where sleeves are not available in the size required for the wire, the Contractor shall use an adhesive label with a white background and black text. Text size shall be in accordance with the requirements listed above.
  7. Adhesive labels, for the case when sleeves are not suitable for the wire size, shall be white permanent vinyl as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal.
  8. Wire identification in manholes, handholes, pull boxes, and other accessible components in the raceway system where the wiring is continuous shall be accomplished by means of a tag installed around the bundled group of conductors. Identification shall utilize a FROM-TO system. Each group of conductors shall consist of all of the individual conductors in a single conduit or duct. The tag shall have text that identifies the bundle in accordance with the 'FROM' and 'TO' column for that particular conduit number in the conduit and wire schedule. Minimum text size shall be 10 point. The tag shall be affixed to the wire bundle by the use of nylon wire ties, and shall be made of polyethylene as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal.
- H. Cabinets, Panels, and Motor Control Centers:
1. Remove surplus wire, bridle and secure.
  2. Where conductors pass through openings or over edges in sheet metal, remove burrs, chamfer edges, and install bushings and protective strips of insulating material to protect the conductors.
- I. Control and Instrumentation Wiring:
1. Where terminals provided will accept such lugs, terminate control and instrumentation wiring, except solid thermocouple leads, with insulated, locking-fork compression lugs.
  2. Terminate with methods consistent with terminals provided, and in accordance with terminal manufacturer's instructions.
  3. Locate splices in readily accessible cabinets or junction boxes using terminal strips.
  4. Cable Protection:
    - a. Under Infinite Access Floors: May install without bundling.
    - b. All Other Areas: Install individual wires, pairs, or triads in flex conduit under floor or grouped into bundles at least 1/2 inch in diameter.
    - c. Maintain integrity of shielding of instrumentation cables.
    - d. Ensure grounds do not occur because of damage to jacket over the shield.
- J. Extra Conductor Length: For conductors to be connected by others, install minimum 6 feet of extra conductor in freestanding panels and minimum 2 feet in other assemblies.

### 3.6 CONDUCTOR ARC AND FIREPROOFING

- A. Wrap conductors of same circuit entering from separate conduit together as a single cable.
- B. Follow tape manufacturer's installation instructions.

- C. Secure tape at intervals of 5 feet with bands of tape binder. Each band to consist of a minimum of two wraps directly over each other.

### 3.7 UNDERGROUND DIRECT BURIAL CABLE

- A. Warning Tape: Install approximately 3 inches above cable, aligned parallel to, and within 12 inches of centerline of the run.

\*\* END OF SECTION \*\*

## SECTION 26 05 29

### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

#### 1 GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Steel slotted support systems.
  - 2. Conduit and cable support devices.
  - 3. Support for conductors in vertical conduit.
  - 4. Structural steel for fabricated supports and restraints.
  - 5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
  - 6. Fabricated metal equipment support assemblies.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
  - 1. Hangers. Include product data for components.
  - 2. Slotted support systems.
  - 3. Equipment supports.
  - 4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
  - 1. Include design calculations and details of hangers.
  - 2. Include design calculations for seismic restraints.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
- C. Welding certificates.

## 1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M.
  - 2. AWS D1.2/D1.2M.

## 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design hanger and support system.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame Rating: Class 1.
  - 2. Self-extinguishing according to ASTM D 635.

### 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
  - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 2. Material for Channel, Fittings, and Accessories: Stainless steel, Type 304.
  - 3. Channel Width: Selected for applicable load criteria.
  - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Stainless Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: Stainless-steel springhead type.
7. Hanger Rods: Threaded steel.

### 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with project requirements for steel shapes and plates.

## 3 EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  1. NECA 1.
  2. NECA 101
  3. NECA 102.
  4. NECA 105.
  5. NECA 111.
- B. Comply with all applicable Codes' requirements for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit.

- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with project installation requirements for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

\*\* END OF SECTION \*\*

## SECTION 26 05 33

### RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### 1 GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

###### B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

##### 1.2 ACTION SUBMITTALS

###### A. Product Data: For each type of product.

###### B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details

##### 1.3 INFORMATIONAL SUBMITTALS

###### A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

###### B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

##### 1.4 REFERENCES

###### A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): HB, Standard Specifications for Highway Bridges, Sixteenth Edition.
2. ASTM International (ASTM):

- a. A123/123M, Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
- b. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- c. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- d. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
- e. D149, Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
- 3. Electronic Industry Alliance (EIA) and Telecommunications Industry Association (TIA): 569, Commercial Building Standard for Telecommunications Pathways and Spaces.
- 4. National Electrical Contractor's Association, Inc. (NECA):
  - a. 101, Standard for Installing Steel Conduit (Rigid, IMC, EMT).
  - b. 102, Standard for Installing Aluminum Conduits.
  - c. 105, Recommended Practice for Installing Metal Cable Trays.
  - d. 111, Standard for Installing Nonmetallic Raceway (RNC, ENT, LFNC).
- 5. National Electrical Manufacturers Association (NEMA):
  - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
  - b. C80.1, Specification for Rigid Steel Conduit, Zinc Coated.
  - c. C80.3, Specification for Electrical Metallic Tubing, Zinc Coated.
  - d. C80.5, Specification for Rigid Aluminum Conduit.
  - e. C80.6, Intermediate Metal Conduit (IMC) – Zinc Coated.
  - f. RN 1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
  - g. TC 2, Electrical Polyvinyl Chloride (PVC) Plastic Tubing and Conduit.
  - h. TC 3, Polyvinyl-Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
  - i. TC 6, PVC Plastic Utilities Duct for Underground Installation.
  - j. TC 14, Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
  - k. VE 1, Metallic Cable Tray Systems.
- 6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
- 7. Underwriters Laboratories Inc. (UL):
  - a. 1, Standard for Flexible Metal Conduit.
  - b. 5, Standard for Surface Metal Raceways and Fittings
  - c. 6, Standard for Electrical Rigid Metal Conduit – Steel.
  - d. 6A, Standard for Electrical Rigid Metal Conduit – Aluminum, Bronze, and Stainless.
  - e. 50, Standard for Enclosures for Electrical Equipment.
  - f. 360, Standard for Liquid-Tight Flexible Steel Conduit.
  - g. 514B, Standard for Conduit, Tubing, and Cable Fittings.
  - h. 514C, Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
  - i. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit.
  - j. 651A, Standard for Type EB and A Rigid PVC Conduit and HDPE Conduit.
  - k. 797, Standard for Electrical Metallic Tubing.
  - l. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
  - m. 1242, Standard for Intermediate Metal Conduit.
  - n. 1660, Standard for Liquid-Tight Flexible Nonmetallic Conduit.
  - o. 1684, Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
  - p. Standard for Optical Fiber and Communication Cable Raceway.

## 1.5 QUALITY ASSURANCE

- A. Authority Having Jurisdiction (AHJ):
  - 1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally

- recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.
  3. PVC-Coated, Rigid Steel Conduit Installer: Certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures.

## 2 PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:
  1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Aluminum Rigid Conduit: Comply with ANSI C80.5 and UL 6A.
  3. IMC: Comply with ANSI C80.6 and UL 1242.
  4. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
  1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Fittings, General: Listed and labeled for type of conduit, location, and use.
  3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
  4. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

### 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Nonmetallic Conduit:
  1. Amoco, Carlon, Certainteed or approved equal.
- B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  1. ENT: Comply with NEMA TC 13 and UL 1653.
  2. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
  3. LFNC: Comply with UL 1660.
- C. Nonmetallic Fittings:
  1. Appleton, Crouse-Hinds, Oz, Thomas & Betts or approved equal.
  2. Fittings, General: Listed and labeled for type of conduit, location, and use.
  3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
  4. Fittings for LFNC: Comply with UL 514B.

5. Solvents and Adhesives: As recommended by conduit manufacturer.

### 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 12 unless otherwise indicated, and sized according to NFPA 70.
  1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

### 2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

### 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50 lb (23 kg)**. Outlet boxes designed for attachment of luminaires weighing more than **50 lb (23 kg)** shall be listed and marked for the maximum allowable weight.
- F. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing **70 lb (32 kg)**.
  1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- K. Gangable boxes are prohibited.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
  - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:
  - 1. NEMA 250, Type 4X stainless steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
  - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
  - 1. Standard: Comply with SCTE 77.
  - 2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
  - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 5. Cover Legend: Molded lettering, "ELECTRIC".
  - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

### 3 EXECUTION

#### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: Aluminum.
  - 2. Concealed Conduit, Aboveground: IMC.
  - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X unless noted otherwise.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
  - 1. Exposed, Not Subject to Physical Damage: Aluminum.
  - 2. Exposed, Not Subject to Severe Physical Damage: RNC identified for such use.
  - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: RNC, Type EPC-80-PVC.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 6. Damp or Wet Locations: Aluminum.
  - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4S stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size above grade and 1" underground.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

#### 3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within **12 inches (300 mm)** of changes in direction.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within **12 inches (300 mm)** of enclosures to which attached.
- L. Raceways Embedded in Slabs:
  - 1. Run conduit larger than **1-inch (27-mm)** trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum **10-foot (3-m)** intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of **2 inches (50 mm)** of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
  - 5. Change from RNC to GRC before rising above floor.
- M. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

- P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to **1-1/4-inch (35-mm)** trade size and insulated throat metal bushings on **1-1/2-inch (41-mm)** trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Surface Raceways:
1. Install surface raceway with a minimum **2-inch (50-mm)** radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inches (1200 mm)** and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Conduit extending from interior to exterior of building.
  4. Conduit extending into pressurized duct and equipment.
  5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  6. Where otherwise required by NFPA 70.
- V. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed **30 deg F (17 deg C)** and that has straight-run length that exceeds **25 feet (7.6 m)**.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C)** temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C)** temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.

3. Install fitting(s) that provide expansion and contraction for at least **0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C)** of temperature change for PVC conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **36 inches (915 mm)** of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors. Flexible conduit shall be type UA Sealtite with copper bands or engineer approved equal.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as required for proper support for pipe less than **6 inches (150 mm)** in nominal diameter.
  2. Install backfill as required for proper conduits installation.
  3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within **12 inches**

- (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
  6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

### 3.4 CONDUIT IDENTIFICATION

- A. Exposed conduits shall be identified at the source, load, and all intermediate components of the raceway system. Examples of intermediate components include but are not limited to junction boxes, pull boxes, condulets, and disconnect switches. Identification shall be by means of an adhesive label with the following requirements:
  1. Labels shall consist of an orange background with black text. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.
  2. In addition, at the source end of the conduit, a second line of text shall be included to indicate the load equipment name. This second line shall consist of the word "TO:" and the text in the 'TO' column of the conduit and wire schedule (e.g. TO: Ferrous Chloride Feed Pump No. 1). At the load end of the conduit, a second line of text shall be included to indicate the source equipment name. This second line shall consist of the word "FROM:" and the text in the 'FROM' column of the conduit and wire schedule (e.g. FROM: PP-6AA). This requirement applies only to the source and load ends of the conduit, and not anywhere in between.
  3. For conduits  $\frac{3}{4}$ " through  $1\frac{1}{2}$ " in size, the text shall be a minimum 18 point font. For conduits 2" and larger, the text shall be a minimum 24 point font.
  4. Label height shall be  $\frac{3}{4}$ " minimum, and length shall be as required to fit required text. The label shall be installed such that the text is parallel with the axis of the conduit. The label shall be oriented such that the text can be read without the use of any special tools or removal of equipment.
  5. Labels shall be installed after each conduit is installed and, if applicable, after painting. Labels shall be printed in the field via the use of a portable label printing system. Handwritten labels are not acceptable.
  6. Labels shall be made of permanent vinyl with adhesive backing as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal. Labels made of any other material are not acceptable.
- B. Conduits that are not exposed but installed beneath free standing equipment enclosures shall be identified by means of a plastic tag with the following requirements:

1. The tag shall be made of white Tyvek material, and have an orange label with black text, as described above, adhered to it. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.
  2. The tag shall be affixed to the conduit by means of a nylon cable tie. The tag shall be of suitable dimensions to achieve a minimum text size of 18 points.
  3. Tags shall be White Tyvek as manufactured by Brady, Seton equivalent, Panduit equivalent, or equal.
- C. Conduits for lighting and receptacle circuits shall not require identification.
- D. Alternatives to this proposed conduit identification method shall be submitted to the Engineer as part of the shop drawing submittal.
- E. Any problems or conflicts with meeting the requirements above shall immediately be brought to the attention of the Engineer for a decision.

### 3.5 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line below grade.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### 3.7 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

### 3.8 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

\*\* END OF SECTION \*\*

## SECTION 26 05 43

### UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

#### 1 GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
1. Metal conduits and fittings, including Aluminum conduit.
  2. Rigid nonmetallic duct.
  3. Flexible nonmetallic duct.
  4. Duct accessories.
  5. Precast concrete handholes.
  6. Polymer concrete handholes and boxes with polymer concrete cover.
  7. Fiberglass handholes and boxes with polymer concrete cover.
  8. Fiberglass handholes and boxes.
  9. High density plastic boxes.

##### 1.2 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
1. Two or more ducts installed in parallel, with or without additional casing materials.
  2. Multiple duct banks.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
1. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
    - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
    - b. Include duct entry provisions, including locations and duct sizes.
    - c. Include cover design.
    - d. Include grounding details.
    - e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Duct and Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- C. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.
- D. Source quality-control reports.
- E. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

### 2 PRODUCTS

#### 2.1 METAL CONDUIT AND FITTINGS

- A. Aluminum: Comply with ANSI C80.1 and UL 6.
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

#### 2.2 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- C. Solvents and Adhesives: As recommended by conduit manufacturer.

#### 2.3 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

#### 2.4 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "ELECTRIC"
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Retain "Duct Entrance Provisions" Paragraph below if duct enters enclosure through side. Otherwise, entry shall be made through an open bottom or through side openings cut in the field. Coordinate with Drawings.
- J. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- K. Handholes 24 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## 2.5 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by an independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## 3 EXECUTION

### 3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with

other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to handholes, and as approved by Architect.

### 3.2 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Feeders 600 V and Less: RNC Type EPC-40-PVC, direct-buried unless otherwise indicated.
- B. Duct for Electrical Branch Circuits: RNC Type EPC-40-PVC, direct-buried unless otherwise indicated.
- C. Underground Ducts Crossing Paved Paths, Driveways and Roadways: RNC Type EPC-40 PVC, encased in reinforced concrete.

### 3.3 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
  - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
  - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
  - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
  - 4. Cover design load shall not exceed the design load of the handhole or box.

### 3.4 EARTHWORK

- A. Excavation and Backfill: Comply with standard practices for excavation and backfill but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures.

### 3.5 DUCT AND DUCT-BANK INSTALLATION

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope duct from a high point between two handholes, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
  - 1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- G. End Bell Entrances to Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.
- H. Terminator Entrances to Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.
- I. Coordinate design of concrete-encased duct approaching building wall penetrations with building structural design to support ducts at wall, without reducing structural or watertight integrity of building. Do not use steel conduit, with or without PVC coating, in highly corrosive soils. Coordinate with Drawings.
- J. Building Wall Penetrations: Make a transition from underground duct to exposed conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-Aluminum transition. Install conduits penetrations of building walls.
- K. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- L. Pulling Cord: Install 200-lbf-test nylon cord in empty ducts.
- M. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with standard practices for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
  2. Width: Excavate trench 12 inches wider than duct on each side.
  3. Width: Excavate trench 3 inches wider than duct on each side.
  4. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
  5. Set elevation of bottom of duct bank below frost line.
  6. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
  7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  8. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
  9. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  10. Install manufactured Aluminum elbows for stub-ups, at building entrances, and at changes of direction in duct.
  11. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with standard practices for installation of backfill materials.
    - a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.
    - b. Place minimum 6 inches of engineered fill above concrete encasement of duct.
- N. Underground-Line Warning Tape: Bury magnetic underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches above all duct banks and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of ductbank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### 3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
  - 1. Concrete: 3000 psi, 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
  - 2. Dimensions: 12 inches wide by 12 inches deep.

### 3.7 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
  - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
  - 3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

### 3.9 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

- B. Clean internal surfaces of handholes, including sump.
  - 1. Sweep floor, removing dirt and debris.
  - 2. Remove foreign material.

\*\* END OF SECTION \*\*

## SECTION 26 05 53

### IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### 1 GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
  - 2. Labels.
  - 3. Bands and tubes.
  - 4. Tapes and stencils.
  - 5. Tags.
  - 6. Signs.
  - 7. Cable ties.
  - 8. Paint for identification.
  - 9. Fasteners for labels and signs.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

#### 2 PRODUCTS

##### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
  - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 240-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
  - 4. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 5. Color for Neutral: White.
  - 6. Color for Equipment Grounds: Green.
  - 7. Colors for Isolated Grounds: Green with white stripe.
- C. Warning Label Colors:
  - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
- E. Equipment Identification Labels:
  - 1. Black letters on a white field.

## 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.
  - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  - 2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors.
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

## 2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.

- c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
    - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
  3. Tag: Type I:
    - a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    - b. Width: 3 inches.
    - c. Thickness: 4 mils.
    - d. Weight: 18.5 lb/1000 sq. ft.
    - e. Tensile according to ASTM D 882: 30 lbf and 2500 psi.
  4. Tag: Type ID:
    - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    - b. Width: 3 inches.
    - c. Overall Thickness: 5 mils.
    - d. Foil Core Thickness: 0.35 mil.
    - e. Weight: 28 lb/1000 sq. ft.
    - f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 TAGS

- A. Write-on Tags:
  1. Polyester Tags: 0.010-inch-thick, with corrosion-resistant grommet and cable tie for attachment.
  2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

## 2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
  3. UL 94 Flame Rating: 94V-0.
  4. Temperature Range: Minus 50 to plus 284 deg F.
  5. Color: Black.

## 2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## 3 EXECUTION

### 3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

- H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "POWER."
  - 3. "UPS."
- M. Vinyl Wraparound Labels:
  - 1. Secure tight to surface at a location with high visibility and accessibility.
  - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
  - 1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
  1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
  2. Limit use of underground-line warning tape to direct-buried cables.
  3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Write-on Tags:
  1. Place in a location with high visibility and accessibility.
  2. Secure using corrosion resistant cable ties.
- Y. Baked-Enamel Signs:
  1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- Z. Metal-Backed Butyrate Signs:
  1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- AA. Laminated Acrylic or Melamine Plastic Signs:
  1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- BB. Cable Ties: General purpose, for attaching tags, except as listed below:
  1. Outdoors: UV-stabilized nylon.
  2. In Spaces Handling Environmental Air: Plenum rated.

### 3.2 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
  - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "POWER"
  - 2. "CONTROLS"
  - 3. "SIGNALS"
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
  - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- J. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels.
  - 1. Apply to exterior of door, cover, or other access.

2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
  - a. Power-transfer switches.
  - b. Controls with external control power connections.
  
- M. Equipment Identification Labels:
  1. Indoor Equipment: self-adhesive label.
  2. Outdoor Equipment: Laminated acrylic or melamine sign.

\*\* END OF SECTION \*\*

## SECTION 26 22 13

### LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

#### 1 GENERAL

##### 1.1 SUMMARY

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
  - 3. Include diagrams for power, signal, and control wiring.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.
- B. Source quality-control reports.
- C. Field quality-control reports.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

##### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

## 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Eaton
- B. General Electric
- C. Square D
- D. Engineer Approved Equal.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified."

### 2.3 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
  - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
  - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- E. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
- F. Coils: Continuous windings without splices except for taps.
  - 1. Coil Material: Copper.
  - 2. Internal Coil Connections: Brazed or pressure type.
  - 3. Terminal Connections: Bolted.

G. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

## 2.4 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand LOCAL seismic conditions.

C. Cores: One leg per phase.

D. Enclosure: Totally enclosed, nonventilated.

1. NEMA 250, Type 12: Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.

E. Taps for Transformers 3 kVA and Smaller: None.

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class, Smaller than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

J. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

K. Wall Brackets: Manufacturer's standard brackets.

## 2.5 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

B. Nameplates: Self-adhesive label for each distribution transformer. Self-adhesive labels are specified in Section 260553 "Identification for Electrical Systems."

### 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

#### 3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
  - 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Secure transformer to concrete base according to manufacturer's written instructions.
- D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- E. Remove shipping bolts, blocking, and wedges.

#### 3.3 CONNECTIONS

- A. Ground equipment to the building grounding system according to Electrical drawings.
- B. Connect wiring according to Electrical drawings.

- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections as required.
- D. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
  - 1. Visual and Mechanical Inspection.
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, and grounding.
    - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
    - d. Verify the unit is clean.
    - e. Perform specific inspections and mechanical tests recommended by manufacturer.
    - f. Verify that as-left tap connections are as specified.
    - g. Verify the presence of surge arresters and that their ratings are as specified.
  - 2. Electrical Tests:
    - a. Measure resistance at each winding, tap, and bolted connection.
    - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
    - c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
    - d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- E. Remove and replace units that do not pass tests or inspections and retest as specified above.

F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

### 3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

**\*\* END OF SECTION \*\***

## SECTION 26 24 16

### PANELBOARDS

#### 1 GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

##### 1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

##### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Key interlock scheme drawing and sequence of operations.
10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

##### 1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.6 FIELD CONDITIONS

- A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

## 1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: **18** months from date of Substantial Completion.

## 2 PRODUCTS

### 2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand local seismic conditions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Surface-mounted, dead-front cabinets.
  1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 12.
  2. Height: 84 inches (2.13 m) maximum.
  3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
  4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- F. Incoming Mains Location: **Bottom**.

- G. Phase, Neutral, and Ground Buses: **Hard-drawn copper, 98 percent conductivity.**
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: **Hard-drawn copper, 98 percent conductivity.**
  2. Main and Neutral Lugs: **Compression** type, with a lug on the neutral bar for each pole in the panelboard.
  3. Ground Lugs and Bus-Configured Terminators: **Compression** type, with a lug on the bar for each pole in the panelboard.
  4. Feed-Through Lugs: **Compression** type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  5. Subfeed (Double) Lugs: **Compression** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- J. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

## 2.3 POWER PANELBOARDS

- A. Manufacturers:
- Square D
  - Eaton

- Siemens
  - Engineer's Approved Equal.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit.
- G. Branch Overcurrent Protective Devices: Fused switches.
- H. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
1. External Control-Power Source: 120-V branch circuit.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers:
- Square D
  - Eaton
  - Siemens
  - Engineer's Approved Equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

### A. Manufacturers:

- Square D
- Eaton
- Siemens
- Engineer's Approved Equal.

### B. MCCB: Comply with UL 489, with series-connected rating to meet available fault currents.

#### 1. Thermal-Magnetic Circuit Breakers:

- a. Inverse time-current element for low-level overloads.
- b. Instantaneous magnetic trip element for short circuits.
- c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

#### 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

#### 3. Electronic Trip Circuit Breakers:

- a. RMS sensing.
- b. Field-replaceable rating plug or electronic trip.
- c. Digital display of settings, trip targets, and indicated metering displays.
- d. Multi-button keypad to access programmable functions and monitored data.
- e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
- f. Integral test jack for connection to portable test set or laptop computer.
- g. Field-Adjustable Settings:
  - 1) Instantaneous trip.
  - 2) Long- and short-time pickup levels.
  - 3) Long and short time adjustments.
  - 4) Ground-fault pickup level, time delay, and I squared T response.

#### 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

#### 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

#### 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).

#### 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.

#### 8. Subfeed Circuit Breakers: Vertically mounted.

#### 9. MCCB Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
- b. Breaker handle indicates tripped status.
- c. UL listed for reverse connection without restrictive line or load ratings.
- d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
- e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
- f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
- h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
- i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

## 2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

# 3 EXECUTION

## 3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NEMA PB 1.1.

C. Comply with mounting and anchoring requirements as required to accommodate local seismic conditions.

- D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.
- J. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

### 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

**\*\* END OF SECTION \*\***

SECTION 31 23 00  
EXCAVATION AND FILL

1 GENERAL

1.1 SCOPE OF WORK

- A. The work covered by this section includes furnishing all labor, materials, and equipment required for all excavation and fill operations including, but not limited to, clearing and grubbing the construction site; dewatering; excavating all classes of material encountered on the construction site; handling, storage, transportation, and disposal of all excavated and unsuitable material; handling, storage, and transportation of all off-site borrow excavation; construction of fills and embankments; backfilling around structures and pipe; backfilling all trenches and pits; compacting; sheeting, shoring and bracing; preparation of subgrades; surfacing and grading, and all other appurtenant earthwork operations which may be necessary to complete the work as specified herein and as shown on the drawings.

1.2 GENERAL

- A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.
- B. The elevations shown on the Drawings as existing are intended to give reasonable, accurate information about the relative elevations. They are not precise, and the Contractor should satisfy himself as to the exact quantities of excavation and fill required.
- C. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
- D. All excavated and filled areas shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.
- E. Earthwork within the rights-of-way of the State Department of Transportation, the County Road Department, and the respective cities shall be done in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications.
- F. The Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Free access must be provided to all fire hydrants, water valves, and meters.
- G. The Owner may decide to conduct tests for compaction and density via an independent testing laboratory. The costs of compaction tests performed by an independent testing laboratory will be paid by the Owner. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests. The cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents shall be paid by the Contractor.
- H. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations.
- I. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and flood plains, particularly in areas where construction activities may encounter water-bearing sands and gravels or limestone solution channels. The Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to him for completing the work within the time specified in these Contract Documents.

## 2 PRODUCTS

### 2.1 STABILIZATION STONE

#### A. For pipe 6" in diameter and greater:

1. No. 57 angular graded crushed stone, 1-inch to 3/16-inches (No. 4) in size with no more than 5 percent passing a No. 8 standard sieve in accordance with ASTM D448.
2. Free from dirt, clay balls and organic material

#### B. For pipes less than 6" in diameter:

1. No. 7 angular graded crushed stone, ½-inch to 3/16-inches (No. 4) in size with no more than 5 percent passing a No. 8 standard sieve in accordance with ASTM D448.
2. Free from dirt, clay balls and organic material

### 2.2 SELECT EARTH BACKFILL

- A. Excavated SM and ML material that is free from rocks larger than ¾-inches in diameter, ashes, cinders, refuse, organic material, frozen soil, and other deleterious material.
- B. Material containing more than 10 percent gravel, stones, or shale particles is not acceptable.
- C. Backfill material shall be within  $\pm 3$  percent of its optimum moisture content.
- D. Provide imported material as required to accomplish work.

### 2.3 COMMON EARTH BACKFILL

- A. Excavated SM and ML material that is free from rocks larger than 3-inches in diameter, ashes, cinders, refuse, organic material, frozen soil, and other deleterious material.
- B. Material containing more than 10 percent gravel, stones, or shale particles is not acceptable.
- C. Backfill material shall be within  $\pm 3$  percent of its optimum moisture content.
- D. Provide imported material as required to accomplish work.

### 2.4 TOP SOIL

- A. The top 6-inches of soil that is suitable for use in seeding and planting.
- B. Free from roots, refuse and any material toxic to plant growth.

### 2.5 CONCRETE

- A. Class "A" concrete in accordance with GDOT Specification Section 500.
- B. Compressive Strength: 3,000 PSI at 28 days

### 2.6 BITUMINOUS TACK COAT

- A. Asphalt cement per GDOT Specification Section 413

### 2.7 ASPHALT PAVEMENT

- A. 12.5-mm superpave per GDOT Specification Section 828

## 3 EXECUTION

### 3.1 GENERAL

- A. Protect all existing utilities (pipes, structures, cables, etc.). Repair all utilities that are damaged by the Contractor, or utilities damaged as a result of Contractor negligence, at no additional cost to the Owner.

### 3.2 INITIAL ACTIVITIES

- A. Notify Utility Protection Center a minimum of 3 days prior to beginning any land disturbing activities.

- B. Install all erosion and sediment control devices prior to beginning any land disturbing activities.

### 3.3 CLEARING AND GRUBBING

- A. Protect all trees, ornamental plantings, and structures within or adjacent to the clearing limits that are shown or specified to not be removed with tree protection fence.
- B. Remove all vegetation, brush, stumps, roots, debris, and any other objectionable matter.
- C. Properly dispose of all materials cleared and grubbed from the project offsite.

### 3.4 PAVEMENT REMOVAL

- A. When approved, remove pavement and road surfaces as required in order to excavate soil.
- B. Saw cut pavement with a rotary saw, making straight cuts along the outside edges of the excavation.
- C. Width of pavement removal for pipe trenches shall be 12-inches greater than the width of the trench on each side.
- D. Remove full width of driveways and sidewalks from control joint to control joint.
- E. Remove curb and gutter from control joint to control joint.
- F. Properly dispose of all materials offsite.

### 3.5 SHEETING, SHORING AND BRACING

- A. Contractor is responsible for trench safety and is responsible for assessing and analyzing the need for sheeting, shoring and bracing.
- B. Install sheeting, shoring and bracing in all open excavation in accordance with the requirements of Title 29 Code of Federal Regulations, Part 1926.650-652, Subpart P, OSHA's Rules and Regulations for Construction Employment.
- C. All excavations more than 5 feet deep must have a protective system in place while workers are present in the excavation.
- D. All excavations more than 4 feet deep must have a way to get in and out of the excavation, usually a ladder, for every 25 feet of horizontal travel.

### 3.6 DEWATERING

- A. Provide all labor, materials, and equipment required to remove and control water as required to accomplish work.
- B. Where running or standing water occurs in an excavation or where the soil in the bottom of an excavation displays a "quick" tendency, the water shall be removed by pumping.
- C. Excavation shall be kept free from water during installation operations by suitable means, such as well points, until materials have been installed and backfill placed and compacted to a sufficient height to prevent flotation.
- D. Properly dispose of water in a manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed work, or adjacent property. Contractor is responsible for any damage caused by the dewatering operation.
- E. Contractor is responsible for obtaining any required permits, required by regulatory agencies, for discharging water from dewatering operations.

### 3.7 SOIL EXCAVATION

- A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish work. Excavate to tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.
- B. Do not over excavate without written authorization of Engineer.
- C. Stockpile top soil separately from other excavated material.

- D. Stockpile excavated soil in a manner that will not obstruct the work or endanger the workers or the public, obstruct sidewalks, driveways, roadways, or other structures.
- E. Do not place excavated soil against tree trunks.
- F. Remove and properly dispose of excavated soil that is unsuitable for backfill or exceeds the quantity required for fill or backfill offsite.

### 3.8 TRENCH EXCAVATION

- A. Excavate trenches to the required alignment, depth, and width required to install the pipe or structure.
- B. Conform to all federal, state, and local regulations for the protection of workers; Contractor is responsible for trench safety.
- C. Width of the trench shall be of sufficient width to install the pipe, accommodate compaction equipment, and make necessary inspections. When required, trenches shall be made wider to permit the placing of shoring.
- D. Trench bottom shall be constructed to provide a firm, stable, and uniform support for the full length of the pipe. Blocking shall not be used to change pipe grade or to intermittently support pipe across excavated sections.
- E. If unsuitable soil exists, the trench shall be over-excavated to remove the unsuitable soil and backfilled with stabilization stone. Engineer shall determine the depth of over excavation.
- F. Open trenches shall be limited to 300 feet in length and shall be backfilled at the end of each work day.
- G. Open trenches shall be barricaded or covered until they are completely backfilled.
- H. Excavated soil that is unsuitable or exceeds the quantity required for backfill shall be disposed of offsite.

### 3.9 PIPE INSTALLATION AND BACKFILL

- A. General
  - 1. Install pipe to the lines and grades shown on the drawings.
  - 2. Install fittings, valves, hydrants, manholes, valve vaults, and other structures in the locations shown on the drawings.
  - 3. Prior to installation, clean all dirt and debris from the interior of pipes, fittings, valves, and other appurtenances.
  - 4. Install materials in accordance the manufacturer's recommendations.
- B. Install PVC pipe in accordance with AWWA C605, Type 5 Bedding
  - 1. PVC pipe shall be bedded to crown of pipe with No. 7 stabilization stone. There shall be a minimum of 4-inches of No. 7 stabilization stone under the pipe. Make sure that material fills the voids under the haunches of the pipe and is properly compacted. Stabilization stone shall be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D698.
  - 2. Backfill from top of pipe to 12-inches above top of pipe with select earth backfill. Backfill shall be placed in 6-inch lifts and mechanically compacted to a minimum of 90 percent (98 percent in pavement) of the maximum dry density, as determined by ASTM D698, prior to placing succeeding lifts.
  - 3. For cuts out of pavement, backfill from 12-inches above top of pipe to finished grade with common earth backfill. Backfill shall be placed in 6-inch lifts and mechanically compacted to a minimum of 90 percent of the maximum dry density, as determined by ASTM D698, prior to placing succeeding lifts.
  - 4. For cuts in pavement, backfill from 12-inches above top of pipe to 20" below finished grade with common earth backfill. Backfill shall be placed in 6-inch lifts and

mechanically compacted to a minimum of 98 percent of the maximum dry density, as determined by ASTM D698, prior to placing succeeding lifts. Backfill from 20" below finished grade to 8" below finished grade with common earth backfill. Backfill shall be placed in 6-inch lifts and mechanically compacted to a minimum of 100 percent of the maximum dry density, as determined by ASTM D698, prior to placing succeeding lifts.

### 3.10 TRENCH REPAIR

#### A. Paved Areas

1. For cuts in pavement, stop backfill 8" below the finished grade.
2. Verify pavement cuts are straight and vertical without jagged edges. If damaged edges or jagged edges exist, cut new edges.
3. Asphalt Pavement
  - a. Install one 4" course of 19-mm Superpave and one 4" course of 12.5-mm Superpave asphalt pavement in accordance with Georgia DOT Standard Specifications for a total asphalt thickness of 8".
  - b. Apply bituminous tack coat at a rate of 0.07 gallons per square yard to the top surface of first course and edges of existing asphalt.
4. Concrete Pavement
  - a. Install 8" of Class "A" High Early Strength Concrete conforming to GDOT Standard Specification Section 500. Concrete strength shall be 3,000 PSI @ 28 days.
  - b. Concrete shall be reinforced with 6"x6" welded wire fabric (W2.9xW2.9).

#### B. Non-Paved Areas

1. Terminate backfill a sufficient depth below finished grade to allow the installation of 4-inches of top soil plus the final cover (seed, sod, etc.)
2. Install 4-inches of top soil and compact to a minimum of 90 percent of the maximum dry density, as determined by ASTM D698.
3. Install grass in accordance with Section 31 25 00 Erosion and Sedimentation Control.

### 3.11 DISPOSAL OF WASTE AND UNSUITABLE MATERIALS

- A. All materials removed by excavation, which are suitable for the purpose, shall be used to the extent possible for backfilling pipe trenches, foundations, and footings and for making embankment fills or for such other purposes as may be shown on the Drawings. All materials not used for such purposes shall be considered as waste materials and the disposal thereof shall be made by the Contractor in a lawful manner and at a location where such materials can be lawfully disposed.
- B. Waste materials shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.
- C. Unsuitable materials, consisting of wood, shot rock, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material shall be removed from the work site and disposed of by the Contractor in a lawful manner.
- D. No unsuitable or waste material shall be dumped on private property unless written permission is furnished by the owner of the property and unless a dumping permit is issued from the local jurisdiction.

### 3.12 FINAL GRADING

- A. After other earthwork operations have been completed, the sites of all structures, roads, and embankments shall be graded within the limits and to the elevations shown on the Drawings. Grading operations shall be so conducted that materials shall not be removed or loosened beyond the required limits. The finished surfaces shall be left in smooth and uniform planes such as are normally obtainable from the use of hand tools. If the Contractor is able to obtain the required degree of evenness by means of mechanical

equipment he will not be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished to slopes shown on the Drawings.

- B. Unless otherwise specified or shown on the Drawings, all finished ground surfaces shall be graded and dressed to present a surface varying not more than plus or minus 0.10 foot as regards local humps or depressions.

### 3.13 TOPSOIL

- A. All areas to be sprigged or planted with grass shall be prepared by grading to a smooth, even surface to a level 4 inches below the elevation of the finished grade shown on the Drawings. It shall then be brought to a neat and finished grade by the addition of 4 inches of approved topsoil.
- B. Topsoil removed from the construction area may be stockpiled and reused or topsoil may be obtained from approved borrow areas. If obtained from borrow areas, the Contractor shall make suitable arrangements with the property owner and shall pay all costs incident to the borrowed material including royalties.

### 3.14 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one year after final acceptance of the work by the Owner.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner.

\*\* END OF SECTION \*\*

SECTION 31 25 00  
EROSION AND SEDIMENTATION CONTROL

1 GENERAL

1.1 SCOPE OF WORK

- A. The work covered by this section includes furnishing all labor, materials, and equipment required to install and maintain temporary erosion and sediment control measures as specified herein and as shown on the drawings.

1.2 SUBMITTALS

- A. Submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.

2 PRODUCTS

2.1 SILT FENCE

A. FILTER FABRIC

1. Type "A" Filter Fabric

- a. Non-woven plastic filter fabric that meets the requirements of Georgia Department of Transportation Standard Specification 881 and is listed in the Georgia Department of Transportation Qualified Products List #36.

2. Type "C" Filter Fabric

- a. Woven plastic filter fabric that meets the requirements of Georgia Department of Transportation Standard Specification 881 and is listed in the Georgia Department of Transportation Qualified Products List #36.

B. Fence Posts

1. Wood Posts

- a. Soft wood: 3" diameter or nominal 2"x4" by minimum 4-feet long and straight enough to provide a fence without noticeable misalignment.
- b. Hardwood (ash, hickory, or oak): 1½"x1½" by minimum 4-feet long with a minus tolerance of ¼" providing the cross sectional area is at least 2.25 in<sup>2</sup>.

2. Steel Posts

- a. "U," "T," or "C" shapes with a minimum weight of 1.3 lbs/ft and a minimum length of 5-feet.
- b. Posts shall have projections for fastening woven wire and filter fabric.

C. Woven Wire Fabric

1. Fabric shall be at least 32-inches high with minimum 6 horizontal wires.
2. Vertical wires shall have a maximum spacing of 12-inches.
3. Top and bottom wires shall be at least 10 gauge.
4. All other wires shall be at least 12.5 gauge.

D. Fasteners for Wooden Posts

1. Wire Staples: Use staples that are at least 17 gauge, legs at least ½-inch long, and a crown at least ¾-inch wide.
2. Nails: Use nails that are at least 14 gauge, 1-inch long, with button heads of at least ¾-inch diameter.

## 2.2 CURB INLET FILTER TRAP

### A. Rock Filter Bags

1. Heavy weight woven or non-woven bags at least 30-inches long, 12-inches wide, and 5-inches thick when filled with rock.

### B. Stone

1. No. 57 Stone

### C. CMU Block

1. 16" long x 8" high per ASTM C129

## 2.3 TEMPORARY GRASSING

### A. Seed

1. August 1 – April 15: Annual Ryegrass – 40 lbs/acre
2. April 1 – August 31: Sudangrass – 60 lbs/acre

### B. Fertilizer

1. Commercial grade
2. N-P-K: 10-10-10

## 2.4 PERMANENT GRASSING

### A. Seed

1. March 1 – May15
  - a. Common Bermuda (Hulled) – 10 lbs/acre
  - b. Common Bermuda (Unhulled) – 10 lbs/acre
  - c. Tall Fescue – 50 lbs/acre
2. May 1 – July 31
  - a. Common Bermuda (Hulled) – 10 lbs/acre
  - b. Common Bermuda (Unhulled) – 10 lbs/acre
3. August 1 – February 28
  - a. Rye Grass – 15 lbs/acre

### B. Fertilizer

1. Commercial grade
2. N-P-K: Per Table 6-5.1 in the "Manual for Erosion and Sediment Control in Georgia" based on time of year.

### C. Lime

1. Ground dolomitic limestone

## 3 EXECUTION

### 3.1 INSTALLATION

- A. Erosion and sediment control practices shall comply with the "Manual for Erosion and Sediment Control in Georgia."
- B. Install erosion and sediment control devices prior to beginning land disturbing activities.
- C. Silt Fence – Sd1
  1. Install according to approved plan, if shown.
  2. Install along contours with ends pointing uphill.
  3. Do not place in waterways or areas of concentrated flow.

4. Start post installation at the center of the lowest point with remaining posts spaced according to the silt fence details.
- D. Curb Inlet Filter Trap – Sd2
1. Install according to approved plan, if shown.
  2. Do not install where vehicular traffic will be affected.
  3. Install at or around all storm drain drop inlets that receive runoff from disturbed areas.
  4. Construct on natural ground surface, excavated surface, or on machine compacted fill.
  5. Span blocks and filter bags across catch basin inlet.
  6. Face openings in blocks outward.
  7. Leave a gap of approximately 4 inches between the curb and the filters to allow for overflow to prevent hazardous ponding.
- E. Disturbed Area Stabilization with Temporary Seeding – Ds2
1. Install all erosion and sediment control measures prior to applying temporary vegetation.
  2. Grading or shaping are not required if slopes can be planted with a hydro-seeder or by hand-seeding.
  3. Seedbed preparation is not required if soil is loose and not sealed by rain.
  4. When the soil is sealed or crusted, it should be pitted, trenched or scarified to provide a place for seed to lodge and germinate.
  5. Agricultural lime is not required.
  6. Fertilize low fertility soils prior to or during planting at the rate of 500-700 pounds per acre of 10-10-10 fertilizer or equivalent (12-16 pounds per 1000 square feet).
  7. Verify the type and germination of the seed to be planted.
  8. Apply seed by hand, cyclone seeder, drill or hydro-seeder. Seed planted with a drill should be planted ¼” to ½” deep.
  9. Temporary cover shall be applied to all disturbed areas left idle for 14 days. If an area is left idle for 6 months, permanent cover shall be applied.
- F. Disturbed Area Stabilization with Permanent Seeding – Ds3
1. Use conventional planting methods.
  2. Apply according to approved plan or according to the “Manual for Erosion and Sediment Control in Georgia.”
  3. Verify the type and germination of the seed to be planted.
  4. Scarify, pit or trench sealed or crusted soil.
  5. Fertilize based on soil tests or as shown in Table 6-5.1 in the “Manual for Erosion and Sediment Control in Georgia.”
  6. Apply agricultural lime as prescribed by soil tests or at a rate of 1 to 2 tons per acre.
  7. Apply seed by hand, cyclone seeder, drill or hydro-seeder. Seed planted with a drill should be planted ¼” to ½” deep.
  8. Straw or hay mulch shall be applied at a rate of 2 to 2.5 tons per acre.
  9. Irrigation should be used to supplement rainfall, but not to the extent to cause erosion.

### 3.2 INSPECTION AND MAINTENANCE

- A. Contractor shall designate a qualified person who is knowledgeable and understanding of erosion and sediment control practices and has completed a certified training course approved by GA EPD to perform inspections required by this specification.
- B. Silt Fence – Sd1

1. Inspect barriers at the end of each working day, or after each rain, and repair or clean as necessary.
  2. Remove sediment from barrier when one-half full.
  3. Dispose of sediment and stabilize it with vegetation.
  4. Replace filter fabric when deteriorated (design life of synthetic filter fabric is approximately 6 months; therefore, contractor shall plan on replacing filter fabric at least this often. There will be no additional payment for replacing filter fabric.).
  5. Maintain until the project is vegetated or otherwise stabilized.
  6. Remove barriers and accumulated sediment and stabilize exposed area when the project is stabilized.
- C. Inlet Sediment Trap – Sd2
1. Inspect, clear, and/or repair trap at the end of each working day.
  2. Do not remove inlet protection and wash sediment into the storm drain.
  3. Remove sediment from the trap and stabilize it with vegetation.
  4. Remove all materials and any unstable soil once the contributing drainage area has been adequately stabilized.
  5. Appropriately stabilize all bare areas around the inlet.
- D. Disturbed Area Stabilization with Temporary Seeding – Ds2
1. Re-seed areas where an adequate stand of temporary vegetation fails to emerge or where a poor stand exists.
- E. Disturbed Area Stabilization with Permanent Seeding – Ds3
1. Re-seed areas where an adequate stand of vegetation fails to emerge or where poor stand exists.
  2. Apply fertilizer per Table 6-5.1 in the "Manual for Erosion and Sediment Control in Georgia."
  3. Mow as required.

### 3.3 REMOVAL OF TEMPORARY SEDIMENT CONTROL STRUCTURES

- A. At such time that temporary erosion and sediment control structures are no longer required, the Contractor shall notify the Engineer of its intent and schedule for the removal of the temporary structures. Contractor shall remove as approved the temporary structures and all sediments accumulated at the removed structure shall be returned upgradient. In areas where temporary control structures are removed, the site shall be left in a condition that will restore original drainage. Such areas shall be evenly graded and seeded as specified.

\*\* END OF SECTION \*\*

SECTION 32 16 13  
CURBS AND GUTTERS

1 GENERAL

1.1 SCOPE

- A. The work included in this section shall include furnishing all labor, materials, and equipment required to install concrete curbs and gutters as shown on the Drawings and specified herein.

1.2 REFERENCES

- A. Cobb County Department of Transportation Standard Specifications
- B. Georgia Department of Transportation Standard Specifications for Road and Bridge Construction

1.3 SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of the Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications:
  - 1. Form Material: Information on metal forms, if used, including type, condition, surface finish, and intended function.
  - 2. Complete data on concrete mix, including aggregate gradations and admixtures in accordance with requirements of ASTM C94.
  - 3. Curing Compound: Manufacturer's Certificate of Compliance and application instructions.
  - 4. Ready-mix delivery ticket for each truck in accordance with ASTM C94.

2 PRODUCTS

2.1 CONCRETE

- A. Ready-mixed concrete conforming to ASTM C94, Option A, with a compressive strength of 3,000 PSI at 28 days.
- B. Maximum Aggregate Size: 1½"
- C. Slump: 2-inches to 4-inches

2.2 EXPANSION JOINT FILLER

- A. One-half inch thick, preformed, asphalt-impregnated expansion joint material conforming to ASTM D994.

2.3 CURING COMPOUND

- A. Liquid membrane forming, clear or translucent, suitable for spray application and conforming to ASTM C309, Type 1.

3 EXECUTION

3.1 INSTALLATION

- A. Perform Work in accordance with Georgia DOT and Cobb County DOT Standards.

3.2 FORMWORK

- A. Lumber Materials:

1. 2-inch dressed dimension lumber, or metal of equal strength, straight, free from defects that would impair appearance or structural quality of completed curb.
  2. 1-inch dressed lumber or plywood may be used where short-radius forms are required.
  3. Metals: Steel in new undamaged condition.
- B. Setting Forms:
1. Construct forms to shape, lines, grades, and dimensions.
  2. Stake securely in place.
- C. Bracing:
1. Brace forms to prevent change of shape or movement resulting from placement.
  2. Construct short-radius curved forms to exact radius.
- D. Tolerances:
1. Do not vary tops of forms from gradeline more than 1/8 inch when checked with 10-foot straightedge.
  2. Do not vary alignment of straight sections more than 1/8 inch in 10 feet.

### 3.3 PLACING CONCRETE

- A. Prior to placing concrete, remove water from excavation and debris and foreign material from forms.
- B. Place concrete as soon as possible, and within 1-1/2 hours after adding cement to mix without segregation or loss of ingredients, and without splashing.
- C. Place, process, finish, and cure concrete in accordance with applicable requirements of ACI 304, and this section. Wherever requirements differ, the more stringent shall govern.
- D. To compact, vibrate until concrete becomes uniformly plastic.

### 3.4 CURB CONSTRUCTION

- A. Construct ramps at pedestrian crossings.
- B. Expansion Joints: Place at maximum 40-foot intervals and at the beginning and end of curved portions of curb, and at connections to existing curbs. Install expansion joint filler at each joint.
- C. Curb Facing: Do not allow horizontal joints within 7 inches from top of curb.
- D. Contraction Joints:
  1. Maximum 10-foot intervals in curb.
  2. Provide open joint type by inserting thin, oiled steel sheet vertically in fresh concrete to force coarse aggregate away from joint.
  3. Insert steel sheet to full depth of curb.
  4. Remove steel sheet with sawing motion after initial set has occurred in concrete and prior to removing front curb form.
  5. Finish top of curb with steel trowel and finish edges with steel edging tool.
- E. Front Face:
  1. Remove front form and finish exposed surfaces when concrete has set sufficiently to support its own weight.
  2. Finish formed face by rubbing with burlap sack or similar device to produce uniformly textured surface, free of form marks, honeycomb, and other defects.
  3. Remove and replace defective concrete.
  4. Apply curing compound to exposed surfaces of curb upon completion of finishing.
  5. Continue curing for minimum of 5 days.

6. Backfill curb with earth upon completion of curing period, but not before 7 days has elapsed since placing concrete.
7. Backfill shall be free from rocks 2 inches and larger and other foreign material.
8. Compact backfill firmly.

\*\* END OF SECTION \*\*

SECTION 40 27 13.11  
CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE AND FITTINGS

1 GENERAL

1.1 SCOPE

- A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test chlorinated polyvinyl chloride (CPVC) pipe and fittings as shown on the Drawings and/or specified herein.

1.2 QUALITY ASSURANCE

- A. Use only pipe and fittings manufactured in the USA.
- B. All pipe shall be tested and inspected at the place of manufacture for all requirements of the latest ASTM and Commercial Standard tests and certified copies of the test reports covering each shipment shall be submitted to the Engineer prior to laying.
- C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:
  - 1. Nominal size
  - 2. Type and grade of material and ASTM standard
  - 3. SDR, class, or schedule rating
  - 4. Manufacturer
  - 5. ANSI/NSF seal of approval

1.3 SHOP DRAWINGS AND ENGINEERING DATA

- A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.

1.4 STORAGE AND PROTECTION

- A. CPVC pipe and fitting shall be stored and protected in accordance with the requirements of the manufacturer, this section, and Section 01 66 00, Product Storage and Handling Requirements.
- B. Protect pipe and fittings stored outdoors from direct exposure to sunlight. Covers must be non-transparent and covering must provide adequate air circulation above and around the pipe to prevent excessive heat absorption.
- C. Store pipe on level ground in the unit packages provided by the manufacturer.
- D. Do not stack pipe more than 8 feet high.
- E. When stacking pipe, make sure the weight of the upper pipe units does not cause deformation of the lower pipe units. Stack palletized pipe wood on wood.
- F. Do not store pipe in tightly enclosed areas subject to elevated temperatures or close to heat producing sources.
- G. Do not drop pipe, drop objects on pipe, or subject pipe to external loads.
- H. Do not drag pipe across the ground or over obstacles.
- I. Remove pipe or fittings found with any scratches, splits, or gouges from the job site.

1.5 GUARANTEE

- A. Provide a guarantee against defective equipment and workmanship in accordance with the requirements of Section 01 78 36, Warranties.

## 2 PRODUCTS

### 2.1 MATERIALS

- A. Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pipe
  - 1. CPVC Material: Type 4, Grade 1 with Cell Classification 23447 per ASTM D1784
  - 2. Construction: Iron pipe size per ASTM F441
  - 3. Maximum Service Temperature: 200 °F
  - 4. Color: Light Gray
- B. Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Fittings
  - 1. CPVC Material: Type 4, Grade 1 with Cell Classification 23447 per ASTM D1784
  - 2. Construction: Per ASTM F439
  - 3. Maximum Service Temperature: 200 °F
  - 4. Color: Light Gray
- C. Double Containment System
  - 1. CPVC double containment system shall be a floating carrier design constructed from conventional pipe and fittings meeting applicable ASTM requirements for all standard configurations of primary carrier and secondary containment.
  - 2. Standard configurations of primary carrier fittings shall be equipped with extender couplings for installation in secondary containment pipe and fittings.
  - 3. Primary carrier system shall be supported by polypropylene slide-on centralizer brackets.
- D. Primer
  - 1. Conform to ASTM F656
- E. Solvent Cement
  - 1. Conform to ASTM F493

## 3 EXECUTION

### 3.1 INSTALLATION

- A. Double containment piping systems shall be installed in accordance with the manufacturer's written instructions.
- B. Cutting
  - 1. Make square and smooth cuts using cutting tools that are designed for use on plastic pipe.
  - 2. Remove burrs from outside and inside of pipe.
  - 3. Place a 10° to 15° bevel approximately 1/16" to 3/32" in width on the end of the pipe.
- C. Solvent Cementing
  - 1. Clean pipe, fittings, and tools so they are free of dirt, moisture, grease, and other contaminants.
  - 2. Condition pipe, fittings, and accessories to same temperature conditions prior to use.
  - 3. Measure socket depth and mark on pipe as a reference mark to ensure pipe is completely bottomed into fitting during assembly.
  - 4. Apply primer to fitting/accessory socket and to pipe end.
  - 5. Apply solvent cement to fitting/accessory socket and to pipe end while primer is still tacky.

6. While both surfaces are still wet with solvent cement, immediately insert the pipe fully into the fitting socket while rotating the pipe ¼ turn. Hold assembly for approximately 30 seconds to ensure initial bonding.
  7. Allow solvent cemented assembly to set for 1 to 5 minutes, depending on pipe size and temperature, without any stress on the joint.
- D. Buried Pipe Installation
1. CPVC pipe for underground pressure applications shall be installed in accordance with AWWA C605 with Type 5 embedment.
  2. Minimum Depth of Cover: 3-feet
  3. Maximum Depth of Cover: 14-feet.
- E. Above Ground Installation
1. Support CPVC pipe and fittings using appropriate pipe supports as specified in Section 22 05 29, Hangers and Supports for Plumbing and Equipment.
  2. Support CPVC pipe at the appropriate pipe support spacing intervals presented in the following table.

CPVC Pipe Support Spacing (feet)		
Pipe Size (inches)	Schedule 40	Schedule 80
¼	2.5	2.5
3/8	2.5	2.5
½	2.5	2.5
¾	2.5	2.5
1	2.5	3
1¼	3	3
1½	3	3.5
2	3	3.5
2½	3.5	4
3	3.5	4
3½	4	4.5
4	4	4.5
6	4.5	5
8	5	5.5
10	5.5	6
12	6	6.5
14	6	8
16	7	8.5
18	7.5	9
20	7.5	9.5
24	8	10

3. Paint all exposed pipe as specified in Section 09 91 00, Painting.
4. Outdoor Applications
  - a. Protect all pipe installed above ground and outside from freezing using insulation and heat trace tape.

### 3.2 FIELD TESTING PIPE

- A. All pressure tests must be witnessed by Engineer.
- B. **DO NOT** pressure test piping assembly with air or compressed gas.
- C. Pressure test piping assembly with water.

- D. All solvent cemented connections must be fully cured prior to pressure testing.
- E. Piping assembly must be adequately anchored/restrained prior to pressure testing.
- F. Pressure test piping assembly to 200% of maximum working pressure or to the maximum working pressure of the lowest pressure rated component in the system, whichever is less.
- G. Test Procedure
  1. Slowly fill system with water, venting air from valves at piping run ends and at elevations during the filling process.
  2. Any slow buildup of gauge pressure or any fluctuating gauge needle on a completely liquid filled system is a strong indication that entrapped air is present in the system. In this case, immediately release pressure and re-bleed line.
  3. Pressurize system to test pressure using hydraulic hand pump or water supply line, if pressure is sufficient.
  4. System must hold pressure for a minimum of 2-hours to demonstrate system integrity.
  5. If leak is found or pressure is not maintained, relieve remaining pressure, cut-out failed sections, replace, and allow time to cure properly prior to retesting.

\*\* END OF SECTION \*\*

SECTION 40 27 13.12  
REINFORCED POLYVINYL CHLORIDE (PVC) HOSE

1 GENERAL

1.1 SCOPE

- A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test reinforced polyvinyl chloride (PVC) hose and accessories as shown on the Drawings and/or specified herein.

1.2 QUALITY ASSURANCE

- A. Use only materials manufactured in the USA.
- B. Store materials in accordance with manufacturers written instructions and Section 01 66 00, Product Storage and Protection.

1.3 SHOP DRAWINGS AND ENGINEERING DATA

- A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.

1.4 STORAGE AND PROTECTION

- A. Materials shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

1.5 GUARANTEE

- A. Provide a guarantee against defective equipment and workmanship in accordance with the requirements of Section 01 78 36, Warranties.

2 PRODUCTS

2.1 MATERIALS

A. Clear Braid Reinforced PVC Hose

- 1. Open mesh polyester braiding permanently encapsulated in walls of clear, flexible PVC tubing.
- 2. Physical Properties
  - a. Working Pressure @ 70 °F: Minimum 100 PSI
  - b. Burst Pressure @ 70 °F: Minimum 270 PSI
  - c. Hardness: 80 ±5 Shore A
  - d. Tensile Strength: 2,500 PSI
  - e. Elongation at Break: 300%
  - f. Brittle Temperature: -50 °F
  - g. Maximum Operating Temperature: 175 °F

3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with the Manufacturers requirements to produce a finished product that is clean and demonstrates true craftsmanship.

\*\* END OF SECTION \*\*



shall be performed by qualified, skilled technicians who are regularly engaged in such activities involving systems of similar complexity, and who possess all licenses and certificates required to perform such work.

## 2 PRODUCTS

### 2.1 GENERAL

- A. Contractor shall note that all valves, especially in the smaller sizes, are not necessarily shown completely on the drawings, which are more or less schematic. However, the Contractor shall furnish and install all valves indicated or required for proper operation of the equipment or services requiring such valves.
- B. Contractor shall be responsible for coordinating the location and position of valve operators. Operator positions for each valve shall be clearly shown in the shop drawings.
- C. Each valve body shall have cast thereon the word "OPEN," an arrow indicating the direction to open, and flow direction arrows.

### 2.2 MATERIALS

#### A. True Union Ball Valves

- 1. Body Material: CPVC Cell Class 23447 per ASTM D1784
- 2. Full port design
- 3. Reversible PTFE seats
- 4. End Connections: True Union/Socket
- 5. Seals
  - a. Ferrous Chloride or Ferric Chloride Service: EPDM
  - b. Sodium Hydroxide Service: EPDM
  - c. Sodium Bisulfite Service: EPDM
  - d. Sodium Hypochlorite Service: FPM
- 6. Ball Valves used for sodium hypochlorite service shall be vented type.
- 7. Pressure Rating
  - a. ½" to 2" Valves: 250 PSI @ 70 °F Non-Shock
  - b. 2½" to 4" Valves: 235 PSI @ 70 °F Non-Shock
- 8. Manufacturers
  - a. Hayward Industries, Inc.
  - b. Or equal

#### B. True Union Ball Check Valves

- 1. Body and Ball Material: CPVC Cell Class 23447 per ASTM D1784
- 2. Horizontal or vertical installation
- 3. Square cut seat for positive sealing
- 4. Seats with minimum back pressure
- 5. End Connections: True Union/Socket
- 6. Seals
  - a. Ferrous Chloride or Ferric Chloride Service: EPDM
  - b. Sodium Hydroxide Service: EPDM
  - c. Sodium Bisulfite Service: EPDM
  - d. Sodium Hypochlorite Service: FPM

7. Pressure Rating: 150 PSI @ 70 °F Non-Shock
  8. Manufacturers
    - a. Hayward Industries, Inc.
    - b. Or equal
- C. Degassing Valve
1. Body Material: CPVC Cell Class 23447 per ASTM D1784
  2. Elastomer Materials
    - a. Ferrous Chloride or Ferric Chloride Service: EPDM
    - b. Sodium Hydroxide Service: EPDM
    - c. Sodium Bisulfite Service: EPDM
    - d. Sodium Hypochlorite Service: FPM
  3. Flat Material: Polypropylene
  4. Pressure Rating: 100 PSI
  5. Connection Size: ½" NPT
  6. Vent Size: 1/8" NPT
  7. Manufacturers
    - a. Plast-O-Matic Valves, Inc.
    - b. Or equal
- D. Basket Strainer
1. Body Material: CPVC Cell Class 23447 per ASTM D1784
  2. Hand removable cover
  3. In-line or loop connections
  4. External cover threads
  5. Integral flat mounting base
  6. End Connections: True Union/Socket
  7. Seals
    - a. Ferrous Chloride or Ferric Chloride Service: EPDM
  8. Basket
    - a. Material: CPVC Cell Class 23447 per ASTM D1784
    - b. Opening Size: 3/16" Perforated
  9. Pressure Rating: 150 PSI @ 70 °F Non-Shock
  10. Manufacturers
    - a. Hayward Industries, Inc.
    - b. Or equal
- E. Y-Strainer
1. Body Material: CPVC Cell Class 23447 per ASTM D1784
  2. Horizontal or vertical installation
  3. Hex cap for access to screen
  4. End Connections: Socket
  5. Seals
    - a. Ferrous Chloride or Ferric Chloride Service: EPDM

- b. Sodium Hydroxide Service: EPDM
- c. Sodium Hypochlorite Service: FPM
- 6. Basket
  - a. Material: CPVC Cell Class 23447 per ASTM D1784
  - b. Opening Size: 3/16" Perforated
- 7. Pressure Rating: 150 PSI @ 70 °F Non-Shock
- 8. Manufacturers
  - a. Hayward Industries, Inc.
  - b. Or equal

### 3 EXECUTION

#### 3.1 INSTALLATION

- A. All process piping valves and accessories shall be installed in conformance with the drawings and manufacturer's instructions.
- B. Valves shall be installed in such a way that operators and packing are easily accessible. Valves with field replaceable seats shall be installed with sufficient clearance to permit removal of valve bonnet and stem without removing valve from the line.
- C. Strainers shall be installed so that there is sufficient clearance to remove strainer baskets.
- D. Following installation and testing, all ferrous and non-machined surfaces of exposed valves, operators, floorstands, and stem guides shall be field primed and painted with a finish suitable for the intended service in accordance with the requirements of Section 09 91 00, Painting.

#### 3.2 FIELD TESTING

- A. Following installation, all valves shall be tested by the Contractor under the anticipated operating conditions. The ability of the valves to operate properly without leakage, binding, sticking, fluttering, or excessive operating torque shall be demonstrated to the satisfaction of the Engineer. The Contractor shall at his own expense adjust and/or replace any valve as necessary to assure satisfactory operation.

**\*\* END OF SECTION \*\***





- G. After installation and before applying insulation, test the system for grounds and short circuits using a 500 VDC meter. Insulation resistance should exceed 10,000 megaohms per 250 feet.

**\*\* END OF SECTION \*\***



### 3 EXECUTION

#### 3.1 INSTALLATION

- A. Ensure that the surfaces over which the insulation is going to be installed are clean and dry.
- B. Ensure the insulation is clean, dry, and in good mechanical condition with factory-applied vapor or weather barriers intact and undamaged. Do not install wet, dirty, or damaged insulation.
- C. Ensure that pressure testing of piping and fittings has been completed prior to installation.
- D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over piping surfaces.
- E. Maintain the integrity of factory-applied vapor retarder jacketing on pipe insulation, protecting it against puncture, tears or other damage. Seal circumferential joints with butt strips that are compatible with vapor retarder jacket facing.
- F. On cold systems, seal penetrations of the vapor retarder jacket and exposed ends of insulation with vapor barrier mastic. Mastic pipe section ends at every fourth pipe section joint and at each fitting to provide isolation of water incursion.
- G. Cover valves, fittings, and similar items in each piping system with one of the following:
  1. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.
  2. Insulation cement, equal in thickness to the adjoining insulation.
  3. PVC fitting covers insulated with material equal in thickness and composition to adjoining insulation.
- H. Seal fitting joints with vapor retarder sealing tapes or mastics.
- I. Use standard oversizing practices for valves and flanges.
- J. Butt pipe insulation against hanger inserts and pipe supports.
- K. After insulation is installed, install aluminum jacket over insulation. Overlap metal jacket 2 to 3 inches and hold in place with metal bands. Seal all joints with solvent welding adhesive.

#### 3.2 FIELD QUALITY ASSURANCE

- A. Upon completion of insulation work, visually inspect the work and verify that it has been correctly installed.

#### 3.3 PROTECTION

- A. Replace damaged insulation, which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. Protect completed work during the remainder of the construction period to avoid damage and deterioration of the finished insulation work.

**\*\* END OF SECTION \*\***

SECTION 40 90 00  
INSTRUMENTATION - GENERAL

1 GENERAL

1.1 SCOPE

- A. The Contractor shall provide, through the services of an instrumentation and control system subcontractor, all components, system installation services, as well as all required and specified ancillary services in connection with the Instrumentation, Control and Information System. The System includes all materials, labor, tools, fees, charges and documentation required to furnish, install, test and place in operation a complete and operable instrumentation, control and information system as shown and/or specified. The system shall include all measuring elements, signal converters, transmitters, local control panels, digital hardware and software, operator workstations, remote telemetry units, signal and data transmission systems, interconnecting wiring and such accessories as shown, specified, and/or required to provide the functions indicated.
- B. The Contractor shall provide, through the services of an instrumentation and control system subcontractor, all components, system installation services, as well as all required and specified ancillary services in connection with the Instrumentation, Control and Information System. The System includes all materials, labor, tools, fees, charges and documentation
- C. The Contractor shall retain overall responsibility for the instrumentation and control system as specified herein.
- D. The scope of the work to be performed under this Division includes but is not limited to the following:
  - 1. Furnish and install process instrumentation and associated taps and supports as scheduled or shown on the Drawings, unless otherwise noted or supplied by equipment vendors.
  - 2. Furnish and install local control panels, field panels and associated cabinets and panels as shown on the Drawings and as specified in Sections 40 90 00 through 40 98 00. Panels shall include, but not be limited to the following:
    - a. Chemical Tank Fill Panel LCP-F1
    - b. Chemical Tank Fill Panel LCP-F2
    - c. Modifications to the existing PLC control panel PLC-401.
  - 3. Furnish and install digital control system hardware and software as specified in Sections 40 90 00 through 40 98 00.
  - 4. Final termination and testing of all instrumentation and control system signal wiring and power supply wiring at equipment furnished under Sections 40 90 00 through 40 98 00.
  - 5. Furnish, install and terminate all special cables (instruments, printers, telemetry, etc.). Furnish and terminate control system communication network cables.
  - 6. Furnish and install surge protection devices for all digital equipment, local control panels, remote telemetry units, and instrumentation provided under this

- Division, including connections to grounding system(s) provided under Division 26.
7. Coordinate grounding requirements with the electrical subcontractor for all digital equipment, local control panels, remote telemetry units, and instrumentation provided under this Division. Terminate grounding system cables at all equipment provided under this Division.
  8. Provide system testing, calibration, training and startup services as specified herein and as required to make all systems fully operational.
- E. It is the intent of the Contract Documents to construct a complete and working installation. Items of equipment or materials that may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically stated herein.

## 1.2 RELATED ITEMS

- A. Field mounted switches, torque switches, limit switches, gauges, valve and gate operator position transmitters, sump pump controls and other instrumentation and controls furnished with mechanical or electrical equipment not listed in the instrument schedule shall be furnished, installed, tested and calibrated as specified under other Divisions.
- B. Additional and related work performed under Division 26 includes the following:
1. Instrument A.C. power source and disconnect switch for process instrumentation, A.C. grounding systems, and A.C. power supplies for all equipment, control panels and accessories furnished under Section 40 90 00 and subsequent Division 40 Sections.
  2. Conduit and raceways for all instrumentation and control system signal wiring, grounding systems, special cables and communication network cables.
  3. Instrumentation and control system signal wiring.
  4. Install control system communication network cables.
  5. Furnish and install grounding systems for all digital equipment, local control panels, remote telemetry units, and instrumentation provided under Section 40 90 00 and subsequent Division 40 Sections. Grounding systems shall be complete to the equipment provided under Section 40 90 00 and subsequent Division 40 Sections, ready for termination by the instrumentation subcontractor.
  6. Termination of all instrumentation and control system signal wiring at all equipment furnished under other divisions of the Specifications.
  7. Final wiring and termination to A.C. grounding systems and to A.C. power sources (e.g. panelboards, motor control centers, and other sources of electrical power).

## 1.3 GENERAL INFORMATION AND DESCRIPTION













4. Completion of all punch-list items that are significant in the opinion of the Engineer.
- B. Final acceptance of the System shall mark the beginning of the extended warranty period.

**\*\* END OF SECTION \*\***



- A. Submittals shall be provided for all control panels, and shall include:
1. Exterior panel drawings with front and side views, to scale.
  2. Interior layout drawings showing the locations and sizes of all equipment and wiring mounted within the cabinet, to scale.
  3. Panel area reserved for cable access and conduit entry.
  4. Location plans showing each panel in its assigned location.
- B. Submit information for all exterior and interior panel mounted equipment including, but not limited to, the following:
1. Bill of materials with equipment names, manufacturers, complete model numbers and locations.
  2. Catalog cuts.
  3. Complete technical, material and environmental specifications.
  4. Assembly drawings.
  5. Mounting requirements.
  6. Color samples.
  7. Nameplates.
  8. Environmental requirements during storage and operation.
- C. Submit panel wiring diagrams showing power, signal, and control wiring, including surge protection, relays, courtesy receptacles, lighting, wire size and color coding, etc.

## 1.5 INSTRUMENT SUBMITTALS

- A. Submit information on all field instruments, including but not limited to the following:
1. Product (item) name and tag number used herein and on the Contract Drawings.
  2. Catalog cuts.
  3. Manufacturer's complete model number.
  4. Location of the device.
  5. Input - output characteristics.
  6. Range, size, and graduations.
  7. Physical size with dimensions, NEMA enclosure classification and mounting details.
  8. Materials of construction of all enclosures, wetted parts and major components.
  9. Instrument or control device sizing calculations where applicable.
  10. Certified calibration data on all flow metering devices.

11. Environmental requirements during storage and operation.
12. Associated surge protection devices.

## 1.6 WIRING AND LOOP DIAGRAMS

- A. Submit interconnection wiring and loop diagrams for all panels and signals in the Control and Information System.
- B. Electrical interconnection diagrams shall show all terminations of equipment, including terminations to equipment and controls furnished under other Divisions, complete with equipment and cable designations. Where applicable, interconnection wiring diagrams shall be organized by input/output card. Interconnecting diagrams shall be prepared in a neat and legible manner on 11 X 17-inch reproducible prints.
- C. Loop drawings shall conform to the latest version of ISA Standards and Recommended Practices for Instrumentation and Control. Loop Drawings shall conform to ISA S5.4, Figures 4-6, Minimum Required Items plus Optional Items.

## 1.7 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall deliver equipment operation and maintenance manuals in compliance with Section 01 78 23 – Operation and Maintenance Data. Operation and maintenance (O&M) manuals shall consist of two basic parts:
  1. Manufacturer standard O&M manuals for all equipment and software furnished under this Division.
  2. Custom O&M information describing the specific configuration of equipment and software, and the operation and maintenance requirements for this particular project.
- B. The manuals shall contain all illustrations, detailed drawings, wiring diagrams, and instructions necessary for installing, operating, and maintaining the equipment. The illustrated parts shall be numbered for identification. All modifications to manufacturer standard equipment and/or components shall be clearly identified and shown on the drawings and schematics. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.
- C. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data and full preventive maintenance schedules. The instructions shall be bound in locking 3-D-ring binders with bindings no larger than 3.5 inches. The manuals shall include 15% spare space for the addition of future material. The instructions shall include drawings reduced or folded and shall provide the following as a minimum.

1. A comprehensive index.
  2. A functional description of the entire system, with references to drawings and instructions.
  3. A complete "as-built" set of all approved shop drawings, which shall reflect all work required to achieve final system acceptance.
  4. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.
  5. Full specifications on each item.
  6. Detailed service, maintenance, and operation instructions for each item supplied.
  7. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
  8. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.
  9. References to manufacturers' standard literature where applicable.
  10. Warning notes shall be located throughout the manual where such notes are required to prevent accidents or inadvertent misuse of equipment.
- D. The operating instructions shall clearly describe the step-by-step procedures that must be followed to implement all phases of all operating modes. The instructions shall be in terms understandable and usable by operating personnel and maintenance crews and shall be useful in the training of such personnel.
- E. The maintenance instructions shall describe the detailed preventive and corrective procedures required, including environmental requirements during equipment storage and system operation, to keep the System in good operating condition. All hardware maintenance documentation shall make reference to appropriate diagnostics, where applicable, and all necessary wiring diagrams, component drawings and PCB schematic drawings shall be included.
- F. The hardware maintenance documentation shall include, as a minimum, the following information:
1. Operation Information - This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.
  2. Preventive-Maintenance Instructions - These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines, and the adjustments necessary for periodic preventive maintenance of the System.
  3. Corrective-Maintenance Instructions - These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction.
  4. Parts Information - This information shall include the identification of each replaceable or field-repairable component. All parts shall be identified on a list in a drawing; the identification shall be of a level of detail sufficient for procuring

any repairable or replaceable part. Cross-references between equipment numbers and manufacturer's part numbers shall be provided.

- G. The O&M information shall also be submitted whole in an electronic format on optical media. Electronic O&M manuals shall contain information in standard formats (Searchable Adobe PDF, Word, AutoCAD, HTML, etc.) and shall be easily accessible through the use of standard, "off-the-shelf" software such as Adobe Acrobat Reader.

## 1.8 FINAL SYSTEM DOCUMENTATION

- A. All documentation shall be delivered to the Owner prior to final system acceptance in accordance with the Contract Documents. As a minimum, final documentation shall contain all information originally part of the control system submittals.
- B. If any documentation or other technical information submitted is considered proprietary, such information shall be designated. Documentation or technical information which is designated as being proprietary will be used only for the construction, operation, or maintenance of the System and, to the extent permitted by law, will not be published or otherwise disclosed.
- C. Provide a complete set of detailed electrical interconnection diagrams required to define the complete instrumentation and control system. All diagrams shall be 11 X 17-inch original reproducible prints. All diagrams shall be corrected so as to describe final "as-built" hardware configurations and to reflect the system configuration and control methodology adopted to achieve final system acceptance.
- D. The as-built drawings shall also be submitted whole in an electronic format on optical media, both in searchable PDF files and in AutoCAD format, version 2010 or later format. All xrefs, shape files, pen table files, and all files necessary to plot in the correct line weights shall be included

## 2 PRODUCTS

(NOT USED)

## 3 EXECUTION

(NOT USED)

\*\* END OF SECTION \*\*

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SECTION 40 90 14  
QUALITY ASSURANCE

1 GENERAL

1.1 THE REQUIREMENT

- A. It is the intent of these Specifications and Drawings to secure high quality in all materials, equipment and workmanship in order to facilitate operations and maintenance of the facility. The Contractor shall provide equipment and services to meet this intent.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. All work shall be installed in accordance with the National Electric Code, National Electric Safety Code, OSHA, State, local, and other applicable codes.

1.3 QUALITY ASSURANCE - GENERAL

- A. All equipment and materials shall be new and the products of reputable recognized suppliers having adequate experience in the manufacture of these particular items.
- B. For uniformity, only one manufacturer will be accepted for each type of product.
- C. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses that may occur during fabrication, transportation, and erection as well as during continuous or intermittent operation. They shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.
- D. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, which shall be of sturdy and durable construction and be suitable for long, trouble-free service.
- E. Electronic equipment shall be all solid state construction, utilizing microprocessors, unless otherwise specified. Components shall be de-rated to assure dependability and long-term stability.
- F. Printed circuit boards in field mounted equipment shall be suitable for the specified environmental conditions.
- G. Alignment and adjustments shall be non-critical, stable with temperature changes or aging and accomplished with premium grade potentiometers.
- H. Components of specially selected values shall not be inserted into standard electronic assemblies in order to meet the performance requirements of this specification.





3 EXECUTION  
(NOT USED)

\*\* END OF SECTION \*\*

## SECTION 40 90 15

### CONTROL AND INFORMATION SYSTEM TESTING – GENERAL

#### 1 GENERAL

##### 1.1 THE REQUIREMENT

- A. The Contractor shall test the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 90 16 – Instrumentation Field Testing

##### 1.3 SUBMITTALS

- A. For each of the specified tests, submit a test plan to the Engineer at least one month in advance of commencement of the tests. The test plan shall contain the following at a minimum:
  - 1. A schedule of all testing to be conducted.
  - 2. A brief description of the testing to be performed
  - 3. Test objectives.
  - 4. Testing criteria per the Specifications.
  - 5. Check lists and procedures for performing each of the specified tests.
  - 6. Sample test result documentation.
  - 7. Requirements for other parties.

##### 1.4 GENERAL REQUIREMENTS

- A. All system start-up and test activities shall follow detailed test procedures; check lists, etc., previously approved by the Engineer. The Engineer shall be notified at least 21 days in advance of any system tests and reserves the right to have his and/or the Owner's representatives in attendance.
- B. The Contractor shall provide the services of experienced factory trained technicians, tools and equipment to field calibrate, test, inspect, and adjust all equipment in accordance with manufacturer's specifications and instructions.
- C. The Contractor (or designee) shall maintain master logbooks for each phase of installation, startup and testing activities specified herein. Each logbook shall include signal, loop or control strategy tag number, equipment identification, description and space for sign-off dates, Contractor signature and Engineer signature. Example test documentation specific to each phase of testing shall be

approved prior to initiation of that testing, as specified hereinabove.

- D. All test data shall be recorded on test forms, previously approved by the Engineer. When each test has been successfully completed, a certified copy of all test results shall be furnished to the Engineer together with a clear and unequivocal statement that all specified test requirements have been met and that the system is operating in accordance with the Contract Documents.
- E. The Engineer will review test documentation in accordance with the Contract Documents and will give written notice of the acceptability of the tests within 10 days of receipt of the test results.

## 2 PRODUCTS

(NOT USED)

## 3 EXECUTION

(NOT USED)

**\*\* END OF SECTION \*\***

SECTION 40 90 16  
INSTRUMENTATION FIELD TESTING

1 GENERAL

1.1 1.01 THE REQUIREMENT

- A. The Contractor shall perform field testing on the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.2 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 90 15 – Control and Information System Testing, General

1.3 GENERAL REQUIREMENTS

- A. Control system start-up and testing shall be performed to ensure that all plant processes shall be systematically and safely placed under digital control in the following order:
  - 1. Primary elements such as transmitters and switch devices shall be calibrated and tested as specified in Section 40 91 10.
  - 2. Each final control element shall be individually tested as specified hereinafter.
  - 3. Each control loop shall be tested as specified hereinafter.
  - 4. Each control strategy shall be tested under automatic digital control as specified hereinafter.
  - 5. The entire control system shall be tested for overall monitoring, control, communications, and information management functions, and demonstrated for system availability as specified hereinafter.
- B. System start-up and test activities shall include the use of water, if necessary, to establish service conditions that simulate, to the greatest extent possible, normal operating conditions in terms of applied process loads, operating ranges and environmental conditions.
- C. Each phase of testing shall be fully and successfully completed and all associated documentation submitted and approved prior to the next phase being started. Specific exceptions are allowed if written approval has been obtained in advance from the Engineer.

## 1.4 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall ensure that all mechanical equipment, equipment control panels, local control panels, field instrumentation, control system equipment and related equipment and/or systems are tested for proper installation, adjusted and calibrated on a loop-by-loop basis prior to control system startup to verify that each is ready to function as specified. Each test shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.
- B. The Contractor shall be responsible for coordination of meetings with all affected trades. A meeting shall be held each morning to review the day's test schedule with all affected trades. Similarly, a meeting shall be held each evening to review the day's test results and to review or revise the next day's test schedule as appropriate.
- C. The Contractor shall ensure that the electrical subcontractor conforms with the start-up, test and sign-off procedures specified herein to assure proper function and coordination of all motor control center control and interlock circuitry and the transmission of all discrete and/or analog signals between equipment furnished by the electrical subcontractor and the control system specified herein.

## 1.5 FINAL CONTROL ELEMENT TESTING

- A. The proper control of all final control elements shall be verified by tests conducted in accordance with the requirements specified herein.
- B. All modulating final control elements shall be tested for appropriate speed or position response by applying power and input demand signals, and observing the equipment for proper direction and level of reaction. Each final control element shall be tested at 0, 25, 50, 75, and 100 percent of signal input level and the results checked against specified accuracy tolerances. Final control elements, such as VFD's, that require turndown limits shall be initially set during this test.
- C. All non-modulating final control elements shall be tested for appropriate position response by applying and simulating control signals, and observing the equipment for proper reaction.

## 1.6 LOOP CHECKOUT

- A. Prior to control system startup and testing, each monitoring and control loop shall be tested on an individual basis from the primary element to the final element, including the operator workstation or loop controller level, for continuity and for proper operation and calibration.
- B. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses. Simulated input data signals may be used subject to prior written approval by the Engineer. All modes of control shall be exercised and checked for proper operation.
- C. The accuracy of all DAC's shall be verified by manually entering engineering unit data values at the operator workstation and then reading and recording the resulting analog output data.

- D. The accuracy of all ADC's shall be verified using field inputs or by manually applying input signals at the final controller, and then reading and recording the resulting analog input data at the operator workstation.
- E. Each loop tested shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion. Coordinate with the Owner to schedule CCWS TSG to be present to witness, date, and sign off on loop testing. Loop testing will not be considered to be completed until signed off by CCWS TSG.

## 1.7 CONTROL SYSTEM STARTUP AND TESTING

- A. Control system startup and testing shall be performed to demonstrate complete compliance with all specified functional and operational requirements. Testing activities shall include the simulation of both normal and abnormal operating conditions.
- B. All digital hardware shall be fully inspected and tested for function, operation and continuity of circuits. All diagnostic programs shall be run to verify the proper operation of all digital equipment.
- C. Final control elements and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using local area control panels, motor control center circuits, and local field mounted control circuits. All hardwired control circuit interlocks and alarms shall be operational. The control to final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits.
- D. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses for final control elements. Simulated input data signals may be used subject to prior written approval by the Engineer.
- E. Each control strategy shall be tested to verify the proper operation of all required functions. The control system start-up and test activities shall include procedures for tuning all control loops incorporating PID control modules, and for adjusting and testing all control loops as required to verify specified performance.
- F. The control system start-up and test activities shall include running tests to prove that the Instrumentation, Control and Information System is capable of continuously, safely and reliably regulating processes, as required by the Contract, under service conditions that simulate, to the greatest extent possible, normal plant operating ranges and environmental conditions.
- G. A witnessed functional acceptance test shall be performed to demonstrate satisfactory performance of individual monitoring and control loops and control strategies. At least one test shall be performed to verify that the control and instrumentation system is capable of simultaneously implementing all specified operations.
- H. Each loop and control strategy test shall be witnessed and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion. Coordinate with the Owner to schedule CCWS TSG to be present to witness, date, and sign off on control strategy testing. Control strategy testing will not be considered to be completed until signed off by CCWS TSG.

## 1.8 FACILITY STARTUP COORDINATION

- A. Facility start-up shall comply with requirements specified in the Contract Documents and those requirements specified herein. Facility start-up shall commence after all previously described start-up and test activities have been successfully completed and shall demonstrate that the Instrumentation, Control and Information System can meet all Contract requirements with equipment operating over full operating ranges under actual operating conditions.
- B. The control system start-up period shall be coordinated with process startup activities and shall be extended as required until all plant processes are fully operational and to satisfy the Engineer that all control system Contract requirements have been fulfilled in accordance with the Contract Documents.

## 2 PRODUCTS

(NOT USED)

## 3 EXECUTION

(NOT USED)

**\*\* END OF SECTION \*\***

## SECTION 40 90 18 FINAL ACCEPTANCE TESTING

### 1 PART 1 -- GENERAL

#### 1.1 THE REQUIREMENT

- A. The CONTRACTOR shall perform the Final Acceptance Test on the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 90 15 – Control and Information System Testing - General
- C. Section 40 90 16 – Instrumentation Field Testing
- D. Section 40 90 17 – Instrumentation Factory Testing

#### 1.3 AVAILABILITY DEMONSTRATION AND FINAL SYSTEM ACCEPTANCE

- A. Upon completion of all control system startup activities and prior to final system acceptance, the CONTRACTOR shall demonstrate that the availability of the entire control system, including operation under conditions of digital equipment fail-over, initiated either automatically or manually, shall be not less than 99.8 percent during a 30-day availability test period. The Owner shall be given two (2) weeks notice of the starting date of the 30-day availability test.
- B. For purposes of determining availability figures, downtime of each system or portions of each system resulting from the causes specified hereunder will not be considered system failures.
  - 1. Downtime of any Ethernet-connected device that is automatically backed-up upon failure shall not be considered a system failure provided that the downtime of the failed component does not exceed 24 hours.
  - 2. Downtime of a PLC that is not automatically backed-up shall be considered a system failure if the downtime of the failed controller exceeds one (1) hour.
  - 3. Downtime of a portion of the system resulting from failure of any field sensor shall not be considered a system failure provided that the system operates as specified under this condition.
  - 4. The failure of the same component more than one time during the 30-day test shall be considered a system failure.
- C. If the system fails the 30-day availability test, the 30-day test period shall be restarted after the failed component or software is repaired/replaced and full operation is restored.
- D. The CONTRACTOR shall submit an availability demonstration report that shall state that all system availability requirements have been met.

2 PRODUCTS

(NOT USED)

3 EXECUTION

(NOT USED)

\*\* END OF SECTION \*\*

SECTION 40 91 10  
INSTRUMENTS - GENERAL

1 GENERAL

1.1 THE REQUIREMENT

- A. The instrumentation subcontractor shall furnish, install, test and place in operation process instrumentation (flow elements, pressure switches, etc.) as scheduled herein together with all signal converters, transmitters, isolators, amplifiers, etc. to interface all instrumentation, panels, controls and process equipment control panels with the process controls as shown on the Drawings and as specified. The Contractor may elect to install primary elements (flowmeters, etc.) on process lines provided that the instrumentation subcontractor provides full on-site supervision during installation. Mounting of associated transmitters, indicators, power supplies, brackets and appurtenances shall be provided as specified herein and shown on the Drawings.
- B. It is the intent of the Contract Documents that all process taps, isolation valves, nipples, penetrations, embedded instrumentation supports, conduit, wiring, terminations, and the installation of process instrumentation on process lines shall be provided under this Contract. The instrumentation subcontractor shall supervise installation of equipment provided under this Division where installation is provided by others.
- C. Tapping and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. The Contractor shall ensure that the location, supports, orientation and dimensions of the connections and tapping for instrumentation furnished under this Division are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 95 13.23 – Main Process Control Panels and Hardware
- C. Section 40 97 00 – Process Control Auxiliary Devices
- D. Unpowered instruments furnished with mechanical equipment shall be furnished, installed, tested and calibrated as specified elsewhere in the Contract Documents.

1.3 TOOLS, SUPPLIES AND SPARE PARTS

- A. Additional items as recommended by the analytical instrument manufacturers or as described for the specified analytical instrument sections shall be provided.

## 2 PRODUCTS

### 2.1 GENERAL

- A. All instrumentation supplied shall be the manufacturer's latest design. Unless otherwise specified, instruments shall be solid state, electronic, using enclosures to suit specified environmental conditions. Microprocessor-based equipment shall be supplied unless otherwise specified. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings, or as required.
- B. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Drawings, to comply with the National Electrical Code.
- C. All field instrumentation for outdoor service shall be provided with enclosures which are suitable for outdoor service, as follows:
  - 1. Where the manufacturer's enclosures are suitable for outdoor service, they shall be provided with instrument sunshades. Sunshades shall be Style E as manufactured by O'Brien Corporation, or equal. Where possible, these instruments shall be mounted in a north facing direction.
  - 2. Where the manufacturer's standard enclosures are not suitable for outdoor service, instruments shall be mounted in Field Panels, or may be furnished with Vipak instrument field enclosures as manufactured by O'Brien Corporation, equivalent by Intertec, or equal. It shall not be necessary to provide the manufacturer's NEMA 4 or 4X enclosures for instruments that will be subsequently mounted in separate field panels.
- D. All instruments shall return to accurate measurement without manual resetting upon restoration of power after a power failure.
- E. Unless otherwise shown or specified, local indicators shall be provided for all instruments.

Where instruments are located in inaccessible locations, local indicators shall be provided and shall be mounted as specified in Subsection 3.01 (B) herein. All indicator readouts shall be linear in process units. Readouts of 0-100% shall not be acceptable (except for speed and valve position). Isolated outputs shall be provided for all transmitters.
- F. Unless otherwise specified, field instrument and power supply enclosures shall be 316 stainless steel, fiberglass or PVC coated copper-free cast aluminum NEMA 4X construction.
- G. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted, installed adjacent to the sensor. Special cables or equipment shall be supplied by the associated equipment manufacturer.
- H. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for long-term performance and dependability over ambient atmosphere fluctuations. Ambient conditions shall be -20 to 50 degrees C and 20 to 100 percent relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid, and corrosive

service conditions.

- I. All devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided, where applicable, shall be of modular construction and shall be capable of field expansion.
- J. All non-loop-powered instruments and equipment shall be designed to operate on a 60 Hz AC power source at a nominal 117 V, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
- K. All analog transmitter and controller outputs shall be isolated, 4-20 milliamps into a load of 0-750 ohms, unless specifically noted otherwise. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless specified otherwise.
- L. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available.

## 2.2 ANALYSIS INSTRUMENTS

- A. Liquid samples shall not pass through housings containing analyzer electronics. Process fluid temperature will be within a range of 40 to 90 degrees F.
- B. Where ambient temperatures will affect accuracy by more than 1 percent of span, a suitable isothermal enclosure with thermostatically controlled space heater shall be provided.
- C. Sample assemblies shall be suitable for submersion or flow-through service as noted and shall be chemically inert to constituents of raw wastewater solids or other chemical environment, as scheduled. Where the sample is drawn prior to filtration, the sample assemblies shall be capable of handling solids and grease.
- D. Each analyzer requiring reagents and/or other replaceable parts shall be furnished with sufficient chemicals and replaceable parts for startup and acceptance tests and the specified warranty period.
- E. Contractor's submittals on these analyzers shall include information on monthly reagent consumption and a list of replaceable parts required for periodic maintenance and the recommended operating periods between replacements. Installation of analyzers and sample preparation shall be in accordance with the analyzer manufacturer's instructions.
- F. Analysis instrumentation performance, accuracy and reproducibility shall be as prescribed in APHA/AWWA/WEF "Standard Methods for the Examination of Water and Wastewater", latest edition. For those measurements specified herein, for which performance characteristics are not listed in the above, the supplier shall state instrument performance characteristics. The "referee" method shall be as prescribed in the most recent version of EPA Methods for Chemical Analysis of Water and Wastes.

## 3 EXECUTION

### 3.1 INSTALLATION

## A. General

1. Equipment shall be located so that it is accessible for operation and maintenance. The instrumentation subcontractor shall examine the Drawings and shop drawings for various items of equipment in order to determine the best arrangement for the work as a whole, and shall supervise the installation of process instrumentation supplied under this Division.
2. Electrical work shall be performed in compliance with all applicable local codes and practices. Where the Contract Documents do not delineate precise installation procedures, API RP550 shall be used as a guide to installation procedures.

## B. Equipment Mounting and Support

1. Field equipment shall be wall mounted or mounted on two-inch diameter pipe stands welded to a 10-inch square by 1/2-inch thick base plate unless shown adjacent to a wall or otherwise noted. Materials of construction shall be aluminum or 316 stainless steel. Instruments attached directly to concrete shall be spaced out from the mounting surface not less than 1/2-inch by use of phenolic spacers. Expansion anchors in walls shall be used for securing equipment or wall supports to concrete surfaces. Unless otherwise noted, field instruments shall be mounted between 48 and 60 inches above the floor or work platform.
2. Embedded pipe supports and sleeves shall be schedule 40, 316 stainless steel pipe, ASA B-36.19, with stainless steel blind flange for equipment mounting as shown on the Drawings.
3. Materials for miscellaneous mounting brackets and supports shall be 316 stainless steel construction.
4. Pipe stands, miscellaneous mounting brackets and supports shall comply with the requirements of Division 5 of the specifications.
5. Transmitters shall be oriented such that output indicators are readily visible.

## C. Control and Signal Wiring

1. Electrical, control and signal wiring connections to transmitters and elements mounted on process piping or equipment shall be made through liquid-tight flexible conduit. Conduit seals shall be provided where conduits enter all field instrument enclosures and all cabinetry housing electrical or electronic equipment.

## 3.2 ADJUSTMENT AND CLEANING

### A. General

1. The instrumentation subcontractor shall comply with the requirements of Division 1 of these Specifications and all instrumentation and control system tests, inspection, and calibration requirements for all instrumentation and controls provided under this Contract and specified herein. The Engineer, or his designated representative(s), reserves the right to witness any test,

inspection, calibration or start-up activity.

Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein shall not relieve the Contractor of his responsibility for meeting all specified requirements.

2. The instrumentation subcontractor shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the Owner. The Contractor shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.
3. At least 60 days before the anticipated initiation of installation testing, the Contractor shall submit to the Engineer a detailed description, of the installation tests to be conducted to demonstrate the correct operation of the instrumentation supplied hereunder.

#### B. Field Instrument Calibration Requirements

1. The instrumentation subcontractor shall provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate each instrument supplied under this Contract to its specified accuracy in accordance with the manufacturer's specification and instructions for calibration.
2. If the manufacturer's recommendations require calibration, each instrument shall be calibrated at 0, 25, 50, 75 and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five (5) times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracy's as set forth by the National Institute for Standards and Technology (NIST).
3. The instrumentation subcontractor shall provide a written calibration sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposed calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but not be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made.
4. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the manufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.
5. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to overvoltages, incorrect voltages, overpressure

or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to the Owner.

6. After completion of instrumentation installation, the instrumentation subcontractor shall perform a loop check. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.

**\*\* END OF SECTION \*\***

SECTION 40 91 23.36  
LEVEL PROCESS MEASUREMENT DEVICES

1 GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the liquid level measurement systems, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 91 00 – Instruments – General

2 PRODUCTS

2.1 ULTRASONIC LEVEL CONTROLLERS

- A. Each ultrasonic level monitoring system shall include one ultrasonic level sensor and an "intelligent" transmitter (controller). The ultrasonic level monitoring system shall be required to monitor the level of liquids as shown on the Drawings and/or as specified herein. Location of the sensor and transmitters shall be as shown on the Drawings and/or as specified.
- B. For outdoor installation, the use of approved watertight conduit hub/glands shall be required. Tank mounting applications shall include mounting flange adapter supplied by the manufacturer, which is compatible with the process liquid and the tank flange connection. Sensor mounting thread shall be 1" NPT.
- C. The level sensor shall be unaffected by moisture droplets on the transducer face and operate on the ultrasonic echo ranging principle. Sensor accuracy shall be a minimum of 0.25 percent of level measurement range, and include integral temperature compensation with an accuracy of 0.01% per degree C. Resolution shall be at least 0.1 percent of full range or 0.08 inches, whichever is greater.
- D. The transmitter shall be programmable with a LCD display, which shall have the capability to display a minimum of 4 characters at one time, and shall be shielded from direct sunlight. The transmitter shall compensate for temperature and air density. The controller shall be capable of performing the following functions: level monitor, both linear and nonlinear level to flow relationships, volumetric, level signals, control of up to 5 pumps, alarms, monitor pump runtime and pump sequencing. Output level signal shall be linear, isolated 4-20 mA DC. Power requirement for the transmitter shall be 120 VAC, 60 Hz. The units shall have a stainless steel or nonmetallic NEMA 4X enclosure. The units shall have as a minimum, the required number of programmable set points to perform the functions specified. Each set point shall operate a set of contacts rated at 10 amps, 120 VAC.

- E. Ultrasonic level measurement system shall be by Siemens, Rosemount, or approved equal.

## 2.2 LEVEL SWITCHES (SUSPENDED FLOAT TYPE)

- A. Level switches of the direct acting float-operated design shall be comprised of a hermetically sealed, approximately 5 inch diameter plastic casing float, containing microswitches and flexibly supported by means of a heavy neoprene or PVC jacket, with three conductor cable a minimum of 20 feet in length. Unless otherwise specified, media specific gravity is 0.95 to 1.05. Microswitches shall be one normally open and one normally closed, 5A-115V AC capacity. Float hangers and supports shall be provided as shown on the installation detail drawings. Float switches shall be Model ENM as manufactured by Flygt, or equal.

## 3 EXECUTION

### 3.1 REQUIREMENTS

- A. Refer to Section 40 91 10.

\*\* END OF SECTION \*\*

SECTION 40 95 13.24  
CABINETS AND PANELS

1 GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the cabinets and panels, with all spare parts, accessories, and appurtenances as specified herein and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 95 13.23 – Main Process Control Panels and Hardware

2 PRODUCTS

2.1 CABINETS AND PANELS

- A. Cabinets and panels shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or equal to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be provided to facilitate maintenance and testing of the cabinet's equipment. Doors shall be removable. Cabinets and panels with any dimension 36 inches or greater shall be provided with removable lifting lugs designed to facilitate safe moving and lifting of the panel during installation. All doors shall be fitted with common- keyed locks.
- B. Cabinets and panels shall be minimum 14 USS gauge. Cabinets and panels with any dimension greater than 36 inches shall be 12 USS gauge.
- C. Cabinets and panels located inside buildings, but located in areas other than climate controlled (heated and air conditioned) electrical or control rooms, shall be as a minimum 316 stainless steel NEMA 4X construction, or as specified or shown on the Drawings for hazardous area classification (Class, Division, Group), or submersible (NEMA 6) applications. Epoxy coated cast copper-free aluminum construction shall also be acceptable for NEMA 4, 6 and 7 applications. Cabinets located in chlorine storage/feed areas shall be of non-metallic, FRP construction, rated NEMA 4X.
- D. Cabinets and panels within climate controlled (heated and air-conditioned) electrical or control rooms shall be all steel fully enclosed NEMA 12 units with gasketed doors.
- E. Cabinets and panels shall have doors on the front and shall be designed for front access. NEMA 12 cabinets shall be fitted with three-point door latches. Door latches for NEMA 4X cabinets shall be all stainless steel, fast operating clamp assemblies that do not require bolts or screws to secure. Door hardware on NEMA 4X cabinets located in chlorine storage/feed areas shall be non-corrosive in that environment.
- F. Panels and cabinets located outside fence-secured areas shall be fitted with padlockable latch kits.
- G. All cabinets and panels shall be provided with drawing pockets for as-built panel drawings. One copy of the appropriate panel as-built drawings shall be furnished and left in the pocket of each panel.
- H. Panels with any dimension greater than 36 inches that contain a programmable

controller (PLC or DCU) shall be provided with a folding laptop programmer shelf on the inside of the door.

- I. Cabinets and panels shall be prefabricated cabinets and panels by Hoffman or Saginaw Control and Engineering (SCE). The Contractor may optionally provide cabinets that are custom-fabricated by the instrumentation subcontractor or by a reputable panel fabrication shop acceptable to the Engineer.

### 3 EXECUTION

#### 3.1 REQUIREMENTS

- A. Refer to Section 40 90 00 for additional requirements.

**\*\* END OF SECTION \*\***

SECTION 40 95 13.25  
PANEL INSTRUMENTS AND ACCESSORIES

1 GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the panel instruments and accessories, with all spare parts, accessories, and appurtenances as specified herein and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 95 13.24 – Cabinets and Panels

1.3 GENERAL INFORMATION AND DESCRIPTION

- A. All equipment mounted on the face of a panel shall conform to the same NEMA rating specified for the panel construction.

2 PRODUCTS

2.1 ELECTRONIC INDICATORS

- A. Electronic indicators shall be 3.5 or 6 digit, as appropriate, with 0.56" high red LED display. Indicators shall be provided with nameplate and scale calibrated to match the calibration of the primary element. The unit shall be designed primarily for use with 4-20 mA current loop signal circuits. Indicator operating voltage shall be 115 VAC 10%, 60 Hz. Indicator controls shall include three (3) front-panel pushbuttons for modifying alarm values and other indicator setup. Two (2) form-C relays shall be provided for each indicator. Relay contact outputs shall be rated 5A, 120/240 VAC, resistive load. Where required, a regulated and isolated 24V excitation power supply shall be provided. Indicators shall be Red Lion Model IMP or APLCL, or equal.

2.2 SIGNAL CONVERTERS

- A. Signal converters shall be provided as required to provide control functions and to interface instrumentation and controls, equipment panels, motor control centers and other instrumentation and controls supplied under other Divisions to the controls provided herein.
- B. General Requirements – Converters shall be of the miniature type, utilizing all solid state circuitry suitable for mounting within new or existing cabinetry. Where sufficient cabinet space is not available, sub panels or supplemental enclosures shall be provided. Power supply shall be 120V, 60 hertz where required by the converter. Repeatability shall be 0.1% of span, deadband shall be 0.1% span,

maximum. Where specific converters are not listed, but are required to interface with the process control system, they shall comply with the general requirements stated herein.

- C. Current to Current Isolators – Current to current isolators shall be furnished where necessary to provide an isolated current loop, calculations or signal amplification between the plant process control system and instrumentation and control loops. Isolators shall be sized such that resistance of existing loops shall not exceed maximum rated resistance. Isolators shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), or equal.
- D. Voltage to Current Transducers – Voltage to current (or current to voltage) transducers shall convert a voltage signal of one magnitude to a 4-20 milliamp DC current signal. The output current shall be directly proportional to the input signal voltage. Transducers shall be sized such that loop resistance does not exceed maximum rated resistance. Transducers shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), or equal.
- E. Frequency to Current Transducers – Frequency to current transducers shall convert pulse-rate and pulse-duration signals to 4-20 mA, 24 VDC analog signals. Converters shall include field-adjustable input frequency range. Converter power shall be 120 VAC, 60 hertz. Transducers shall be sized such that loop resistance does not exceed maximum rated resistance. Transducers shall be suitable for signal transmission via leased telephone lines. Transducers shall be Timeverter as manufactured by AGM, Moore Industries equivalent, Rochester Instrument Systems (RIS) equivalent, or equal.
- F. Current to Frequency Transducers – Current to frequency transducers shall convert 4-20 mA, 24 VDC analog signals to pulse-rate and pulse-duration signals. Converters shall include field-adjustable output frequency range. Converter power shall be 120 VAC, 60 hertz. Transducers shall be sized such that loop resistance does not exceed maximum rated resistance. Transducers shall be suitable for signal transmission via leased telephone lines. Transducers shall be Quantimer as manufactured by AGM, Moore Industries equivalent, Rochester Instrument Systems (RIS) equivalent, or equal.
- G. Integrators – Integrators shall be provided as interchangeable plug-in modules with zero and span adjustment available on the front plate of the units. Output shall range from 0 to 0.1 through 0 to 10 pulses per second. Accuracy shall be  $\pm 0.1\%$  of input span. Integrators shall convert linear analog signals to pulse rate and provide a solid-state output. Integrators shall be as manufactured by AGM Electronics, Moore Industries, Rochester Instrument Systems (RIS), or equal.
- H. Electronic Switches (Alarm Relays) – Electronic switches shall be furnished with a calibrated dial for adjusting set points. The input to the switch shall be 4-20 mA DC, and the set point shall be adjustable over the full range. Unless otherwise noted, the dead band shall be fixed at less than 2 percent of span. The set point stability shall be  $\pm 0.1\%$  per degree F. The repeatability shall be  $\pm 0.1\%$  of span. The units shall be furnished with SPDT relays rated at 10 amperes at 115 VAC. Electronic switches shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), or equal.
- I. RTD to Current Signal Converters – RTD to current signal converters shall convert a 3-wire RTD input signal to an isolated 4-20 mA DC output signal. Each converter shall operate from a 120 VAC power source. Accuracy shall be 0.10 percent of span or better. Calibrated span of each converter shall be as indicated on the instrument list. The Contractor shall coordinate calibration of the signal converters

with existing RTD elements. The signal converters shall be furnished in the manufacturer's standard enclosure for installation in an existing indoor electrical cabinet. Signal converters shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), or equal.

- J. Interposing Relays – Where required to interface between motor control centers, equipment controls, and control panels, interposing relays and associated control wiring circuitry shall be furnished and installed to provide the monitoring and/or control functions specified herein. Interposing relays shall be miniature type, DPDT, minimum 10 amp, 120 VAC contact rating, with LED indicators. Relay coils shall be 120 VAC or 24 VDC as required. Relays shall be Type KU as manufactured by Square D, Potter & Brumfield, Allen-Bradley, or equal.
- K. Timing Relays – Timing Relays (TR) shall be the general purpose plug-in type, Type JCK as manufactured by Square D Company, Cutler-Hammer/Westinghouse Electric Corporation equivalent, Allen-Bradley equivalent, or equal. Timing relays shall be electronic type with 120 VAC coils unless otherwise specified or indicated on the Drawings. Timers shall be provided with a minimum of two SPDT timed output contacts and instantaneous contacts where required. Contact ratings shall be the same as for interposing relays as specified above.
- L. Intrinsically Safe Relays and Barriers – Intrinsically safe relays and barriers shall be provided where required to interface with equipment such as float level switches that are located in NFPA-classified hazardous areas. Intrinsically safe relays and barriers shall be FM approved and shall be manufactured by Pepperl and Fuchs, Crouse Hinds, Square D, or equal.

### 2.3 ACCESSORIES

- A. Control operators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be Cutler-Hammer/Westinghouse Type E34, Square D Company Type SK, or equal. Control operators shall be 30.5 mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant.
- B. Pushbuttons and selector switches shall be non-illuminated, spring release type. Pushbuttons shall include a full guard. Panic stop/alarm pushbuttons shall be red mushroom type with manual-pull release. Pilot lights shall be of the proper control voltage, LED type with light lens colors shall be as specified below.

<u>Color</u>	<u>Function</u>
Red	Running (Open)
Green	Stopped or Off (Closed)
Amber	Fault
White	Other

- C. Control operators shall have legend plates as specified herein, indicated on the Drawings, or otherwise directed by the Engineer. Legend plates shall be plastic, black field (background) with white lettering. Engraved nameplates shall be securely fastened above each control operator. If adequate space is not available, the nameplate shall be mounted below the operator.
- D. Control operators for all equipment shall be as specified herein and of the same type and manufacturer unless otherwise specified or indicated on the Drawings.

- E. Alarm horns shall be general-purpose type, flush panel mount, 115 VAC power supply or 24 VDC power supply, suitable for indoor or weatherproof service, as required. Volume shall be adjustable.

### 3 EXECUTION

#### 3.1 REQUIREMENTS

- A. Refer to Section 40 95 13.23 and referenced sections for additional requirements.

**\*\* END OF SECTION \*\***

SECTION 40 95 58  
SURGE PROTECTIVE DEVICES

1 GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall furnish, install and place in satisfactory operation the surge protection devices (SPDs) as specified herein and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 95 13.23 - Main Process Control Panels and Hardware
- C. Section 40 95 13.24 - Cabinets and Panels

1.3 GENERAL INFORMATION AND DESCRIPTION

- A. All surge protectors of each type provided under this Contract shall be furnished by a single manufacturer.

1.4 TOOLS, SUPPLIES AND SPARE PARTS

- A. The following specific spare parts items shall be provided:
  - 1. Five of each type of surge protection device provided under this Contract.

## 2 PRODUCTS

### 2.1 ELECTRICAL TRANSIENT PROTECTION, GENERAL

- A. All electrical and electronic elements shall be protected against damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical systems.
- B. Manufacturer's Requirements: All surge protection devices shall be manufactured by a company that has been engaged in the design, development, and manufacture of such devices for at least 5 years. .
- C. Surge protection device installations shall comply with UL 94, the National Electric Code (NEC), and all applicable local codes.
- D. Surge protection devices shall be installed as close to the equipment to be protected as practically possible.
- E. Device Locations: As a minimum, provide surge protection devices at the following locations:
  - 1. At any connections between ac power and electrical and electronic equipment, including panels, assemblies, and field mounted analog transmitters.
  - 2. At both ends of all analog signal circuits that have any portion of the circuit extending outside of a protecting building.
  - 3. At both ends of all discrete signal circuits that have any portion of the circuit extending outside of a protecting building.
  - 4. At both ends of all copper-based communications cables which extend outside of a building, including at field instruments and the field side of analog valve position signals.
  - 5. On all external telephone communications lines.

### 2.2 AC POWER PROTECTION

- A. Surge protection device assemblies for connections to AC power supply circuits shall:
  - 1. Be provided with two 3-terminal barrier terminal strips capable of accepting No. 12 AWG solids or stranded copper wire. One terminal strip shall be located on each end of the unit.
  - 2. Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements. The surge protection device shall be provided with provisions for mounting to interior of equipment racks, cabinets, or to the exterior of freestanding equipment.
  - 3. Be constructed as multistage devices consisting of gas tube arrestors, high energy metal oxide varistors, or silicon avalanche suppression diodes. Assemblies shall automatically recover from surge events, and shall have status indication lights.
  - 4. Comply with all requirements of UL 1449, second edition.

5. Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.
6. Have the following characteristics:
  - a. Maximum Continuous Operating Voltage: 150VAC
  - b. Maximum Operating Current: 20 amps
  - c. Ambient Temperature Range: -20 degrees C to +65 degrees C
  - d. Response Time: 5 nanoseconds
7. Acceptable manufacturers: Phoenix Contact, Edco. No others will be accepted.:

## 2.3 ANALOG SIGNAL CIRCUIT PROTECTION

- A. Surge protection device assemblies for analog signal circuits shall:
  1. Have four lead devices with a threaded mounting/grounding stud or DIN Rail mounting.
  2. Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements.
  3. Be constructed as multistage devices consisting of gas tube arrestors and silicon avalanche suppression diodes. Gas tube arrestors and diodes shall be separated by a series impedance of no more than 20 ohms. Assemblies shall automatically recover from surge events.
  4. Comply with all requirements of UL 497B.
  5. Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.
  6. Limit line-to-line voltage to 40 volts on 24VDC circuits.
  7. Have the following characteristics:
    - a. Maximum Continuous Operating Voltage: 28VDC
    - b. Ambient Temperature Range: -20 degrees C to +65 degrees C
    - c. Response Time (Line-to-Line): 5 ns
  8. Acceptable Manufacturer: Phoenix Contact. No others will be permitted.

## 2.4 DISCRETE SIGNAL CIRCUIT PROTECTION

- A. Surge protection device assemblies for discrete signal circuits shall:
  1. Have four lead devices with a threaded mounting/grounding stud or DIN Rail mounting.
  2. Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements.

3. Be constructed as multistage devices consisting of gas tube arrestors and silicon avalanche suppression diodes. Gas tube arrestors and diodes shall be separated by a series impedance of no more than 20 ohms. Assemblies shall automatically recover from surge events.
4. Comply with all requirements of UL 497B.
5. Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.
6. Have the following characteristics:
  - a. Nominal Voltage: 120 VAC
  - b. Ambient Temperature Range: -20 degrees C to +65 degrees C
  - c. Response Time (Line-to-Line): 5 ns
7. Acceptable Manufacturer: Phoenix Contact. No others will be permitted.

## 2.5 COMMUNICATION CIRCUIT PROTECTION

- A. Surge protection devices for copper-based data communication circuits shall:
  1. Be certified for the specific data communication protocol and media to be protected (i.e. telephone, serial, parallel, network, Modbus, Profibus, Ethernet, Data Highway Plus, Modbus Plus, coax, twinaxial, twisted pair, RF, etc.).
  2. Provide protection of equipment to within the equipment's surge withstand levels for applicable standard test wave forms of the following standards:
    - a. IEC 60-1 / DIN VDE 0432 part 2
    - b. CCITT K17 / DIN VDE 0845 part 2
    - c. IEEE C62.31
  3. Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements.
  4. Provide automatic recovery.
  5. Acceptable Manufacturer: Phoenix Contact. No others will be permitted.

## 3 EXECUTION

### 3.1 REQUIREMENTS

- A. Refer to Section 40 95 13.23 for additional requirements.

**\*\* END OF SECTION \*\***

SECTION 40 97 00  
PROCESS CONTROL AUXILIARY DEVICES

1 GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the instrumentation and control system accessories with all spare parts, and appurtenances as herein specified and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 40 90 00 – Instrumentation and Control for Process Systems - General Requirements
- B. Section 40 91 10 – Instruments, General

2 PRODUCTS

2.1 INSTRUMENTATION AND CONTROL SYSTEM ACCESSORIES

- A. General: Accessories include various items of equipment that may be required in the system but are not scheduled. Accessories are shown on details, flow sheets or plans. Accessories are also called out in specifications for scheduled instruments and in the installation specifications. It is not intended, however, that each piece of hardware required will be specifically described herein. This subarticle shall be used as a guide to qualify requirements for miscellaneous hardware whether the specific item is described or not.
- B. Process Tubing: Process tubing shall be 1/2 x 0.065-inch seamless, annealed, ASTM A-269 Type 316L stainless steel with Type 316 - 37 degrees stainless steel flared fittings or Swagelock or Parker-CPI flareless fittings.
- C. Power, Control and Signal Cables: Power, control and signal wiring shall be provided under Division 26 of the Specifications.
- D. Chemical Diaphragm Seals: Diaphragm seals shall be provided for isolation of pressure gauges, switches and transmitters attached to systems containing chemical solutions or corrosive fluids. As a minimum, seals shall be of all 316 stainless steel construction. In general, diaphragms shall be 316L stainless steel for operating pressures at or above 15 psi and elastomers for operating pressures below 15 psi. However, diaphragm material shall be non-reactive with the process fluid in all cases. Refer to the Instrument Schedules for specific materials requirements. Seal shall have fill connection, 1/4-inch NPT valved flush port and capable of disassembly without loss of filler fluid. Where specified, diaphragm seals shall comply with the above requirements and shall be provided with 316 SS factory filled capillaries. Seals shall be Helicoid Type 100 HA, Mansfield & Green, Ashcroft, or equal.
- E. Isolating Ring Seals: For solids bearing fluids, line pressure shall be sensed by a flexible cylinder lining and transmitted via a captive sensing liquid to the

associated pressure sensing instrument(s).

1. Full Line Size Isolating Ring Seals - For all grit/sludge/slurry/scum applications or wherever the associated pressure instrument is used for control purposes, the sensor body shall be full line size wafer design. Except where noted on the Drawings and/or Instrument Schedule, full line size ring seals will not be required for return activated sludge (RAS) lines, but will have tapped ring seals as specified in Item 2, below. Full line size isolating ring seals shall have 316 stainless steel housing and assembly flanges and Buna N flexible cylinder lining for in-line mounting. The wafer shall have through bolt holes or centerline gauge for positive alignment with the associated flanged piping. The captive liquid chamber and associated instrument(s) shall be furnished with threaded drain tap and plug. Isolating ring seals shall be RED Valve Series 40, Ronningen-Petter Iso-Ring, Moyno RKL Series W, Onyx Isolator Ring, or equal.
  2. Tapped Isolating Ring Seals - For all other solids bearing fluids, pressure shall be sensed via a minimum 1/2" diameter spool-type isolating ring seal mounted on a 1/2" pipe nipple at 90° from the process piping. An isolation ball valve shall be provided between the process piping and the ring seal, and a cleanout ball valve shall be provided between the ring seal and the atmosphere. The pressure instrument shall be back or side mounted to the ring seal such that the gauge or readout may be viewed normally. Tapped isolating ring seals for solids service shall be Red Valve Series 42/742, Ronningen-Petter Iso-Spool, Onyx Isolator Ring, or equal.
- F. Filling Medium: The filling medium between instruments, isolating ring seals and diaphragm seals shall be a liquid suitable for operation in an ambient temperature ranging from -10°F to +150°F. Filling medium shall be silicone unless oxidizing agents such as sodium hypochlorite are present, where halocarbon shall be used.
- G. Isolation Valves: Isolation valves shall be 1/2 - inch diameter ball valves with 316 stainless steel body, 316 stainless steel ball, except that materials of construction shall be suitable for the associated process fluid where applicable (i.e., chemical service).
- H. Sirens: Sirens shall be UL Listed, heavy duty, AC motor driven, weatherproof type capable of producing a minimum of 111 dBA at 10 feet. Power supply shall be 120 VAC, 60 hertz. Siren shall be McMaster-Carr Model 6392T11, Federal Signal Corporation equivalent, Edwards Signaling Company equivalent, or equal.
- I. Strobe Lights: Strobe lights shall be high profile with thermoplastic base. Light shall be rated NEMA 4X. Light shall have an outer dome to provide extra lens protection. Lens color shall be as scheduled or otherwise indicated. Surface mount and integrated 1/2 inch pipe mount hardware shall be included. Power supply shall be 120 VAC, 60 hertz. Strobe light shall be Model FB2PST by Federal Signal Corporation; McMaster-Carr equivalent, Edwards Signaling Company equivalent, or equal.

### 3 EXECUTION

#### 3.1 REQUIREMENTS

A. Refer to Section 40 91 10, Part 3 of the specifications.

**\*\* END OF SECTION \*\***

SECTION 43 41 43  
HIGH DENSITY CROSS-LINKED POLYETHYLENE STORAGE TANKS

1 GENERAL

1.1 SCOPE OF WORK

- A. The work covered by this section includes furnishing all labor, materials, and equipment required to install, test, and place into satisfactory operation high density cross-linked polyethylene storage tanks and appurtenances as specified herein and as shown on the drawings.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications.
  - 1. Dimensional drawings of tanks showing the location and orientation of openings, fittings, accessories, restraints, and supports
  - 2. Tank and fitting material
    - a. Resin manufacturer data sheet
    - b. Fitting material
    - c. Gasket style and material
    - d. Hardware material
  - 3. Calculations prepared and stamped by an engineer registered in the state of Georgia.
    - a. Wall thickness calculations per ASTM D 1998 using 600 PSI design hoop stress
    - b. Tank restraint system
  - 4. Electrical heat trace and foam insulation data sheets
  - 5. Printed warranty
  - 6. Certified Factory Test Report
    - a. Material verification
    - b. Wall thickness verification
    - c. Fitting placement verification
    - d. Visual inspection
    - e. Impact test
    - f. Gel test
    - g. Hydrostatic test

1.3 OPERATION AND MAINTENANCE DATA

- A. The Contractor shall provide operation and maintenance data in accordance with the requirements of Section 01 78 23, Operation and Maintenance Data.

1.4 STORAGE AND PROTECTION

- A. Equipment shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

1.5 WARRANTIES AND BONDS

- A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01 78 36, Warranties.

- B. The equipment manufacturer shall provide a warranty against defective or deficient equipment, workmanship and materials under normal use, operation and service. The warranty shall be for five (5) years from the date of Engineer's acceptance of the work. The warranty shall be in printed form and apply to all similar units.

## 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Approved manufacturers include:
1. Assmann Corporation of America
  2. Poly Processing Company
  3. Snyder Industries, Inc.

### 2.2 DESIGN CRITERIA

- A. Provide four (4) high density cross-linked polyethylene storage tanks (T-1360A, T-1360B, T-1360C, and T-1360D) that meets the following design criteria.

Storage Volume	Minimum 12,000 Gallons
Chemical Stored	Ferrous Chloride <u>or</u> Ferric Chloride
Chemical Concentration	~20% FeCl <sub>2</sub> / ~40% FeCl <sub>3</sub>
Specific Gravity	1.28
Minimum Ambient Air Temperature	0°F
Tank Diameter	Maximum 12'-0" (Note: Tanks and tank restraint must fit on existing tank pads which are octagonal in shape and are approximately 13'-6" flat-to-flat)
Tank Specific Gravity Rating	1.90
Exposure	Outside

### 2.3 CONSTRUCTION

- A. General
1. Tanks shall be rotationally-molded, vertical, high density cross-linked polyethylene, one-piece seamless construction, cylindrical in cross-section, flat bottomed, domed top, and vertical.
  2. Tanks shall be provided with an entrance man-way, fittings, electrical heat tracing, spray-on urethane foam insulation, and exterior coating.
  3. Tanks shall have no bolt hole penetrations through the tank wall below the maximum storage level except for the flanged suction pipe connection. Full drain outlet shall be integrally molded to the tank. Anchorage of accessories (ladder, fill line, overflow line reverse float gauge, etc.) to the sidewalls shall be accomplished with metal straps with welded on threaded studs that wrap around the tank or other external type supports.
  4. Tanks shall be marked to identify the manufacturer, date of manufacture and serial number.
  5. Unless otherwise specified, all metallic hardware, bolts, nuts, washers, etc. shall be Grade 2, titanium.
  6. All gasket materials shall be EPDM.
- B. Polyethylene Storage Tanks

1. Tanks shall be manufactured using high density cross-linked polyethylene resin manufactured by Exxon Mobil Chemicals, or equal.
2. All materials shall be NSF/ANSI Standard 61 certified for storage of the specified chemical(s).
3. Resin shall contain a minimum of a UV 8 ultraviolet stabilizer.
4. Tank material shall meet or exceed the following properties:

<b>Property</b>	<b>ASTM</b>	<b>Value</b>
Density, g/cc	D1505	0.938-0.946
Environmental Stress Cracking Resistance, F50, hours, 10% Igepal	D1693	>1,000
Tensile Strength, Ultimate PSI, 2-inch/minimum	D638	>2,600
Elongation at Break, %, 2-inch/minimum	D638	>300
Vicat Softening Point, °F	D1525	248
Impact Brittleness Temperature, °F	D746	< -180
Flexural Modulus, PSI	D790	87,000

5. Wall thickness for a given hoop stress is to be calculated in accordance with ASTM D 1998. Tanks shall be designed using a hoop stress no greater than 600 psi at 100 °F. Wall thickness calculations shall assume that all tank contents have a specific gravity of not less than 1.9.
6. In NO case shall the tank thickness be less than design thickness.
7. The wall thickness of any cylindrical portion at any fluid level shall be determined by the following equation.

$$T = P \times OD/2SD \text{ or } 0.433 \times SG \times OD \times H \times OD/2SD$$

Where:

- T = wall thickness, in
- P = pressure, psi
- SG = specific gravity, gm/cc
- H = fluid head, ft
- OD = outside diameter, ft
- SD = hydrostatic design stress, 600 psi

8. The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.1875" thick.
9. Top head shall be integrally molded with the cylindrical wall. Its minimum thickness shall be equal to the thickness of the top of the straight sidewall. In most cases, flat areas shall be provided for attachment of large fittings on the dome of the tank.
10. Bottom head shall be integrally molded with the cylindrical wall.
  - a. The minimum Knuckle Radius for tanks with a diameter less than or equal to 6-feet shall be 1-inch.
  - b. The minimum Knuckle Radius for tanks with a diameter greater than 6-feet shall be 1-1/2 inch.
11. Tank identification shall be permanently embossed into tank.
  - a. Manufacturer
  - b. Date of Manufacture

- c. Serial Number
- 12. Tanks shall have a minimum of 3 lifting lugs.
  - a. Lifting lugs shall be designed for lifting the tank when it is empty.
- 13. Tanks shall have a minimum of 4 tie-down lugs.
  - a. Design tie-down lugs in accordance with 2012 International Building Code with 2014 Georgia Amendments. Assume 100 MPH wind load. Design shall be sealed by a structural engineer registered in the state of Georgia.
  - b. Metal components shall be Type 316 stainless steel and cables shall be PVC/vinyl coated Type 316 stainless steel.
  - c. Existing tie-down lugs shall not be reused.
- 14. Manways
  - a. Provide 24-inch diameter manway. Manway hatch shall automatically release to prevent over pressuring the tank.
  - b. Metal components shall be Grade 2, titanium.
  - c. Gasket material shall be EPDM.
- 15. Tank color shall be natural.

## 2.4 TANK ACCESSORIES

### A. Ladder

- 1. Provide fiberglass access ladder with safety cage and standing platform with handrails for each tank.
- 2. Standing platform shall be minimum 24" x 24" square and shall be located 48" below the top of the tank. Safety handrails around standing platform shall be supplied.
- 3. Ladder anchors shall not penetrate the tank wall below the maximum storage elevation.
- 4. Use proper chemical resistant materials when anchoring to tank dome.
- 5. Ladders shall be designed to OSHA standard 2206; 1910.27.
- 6. Ladder design shall be designed to OSHA Standard 2206; 1910.27.
- 7. Ladders shall be mounted in a manner that will allow for tank expansion and contraction due to temperature and loading changes.
- 8. Fiberglass material shall be premium grade polyester resin with flame retardant and UV inhibitor additives.
- 9. Color: yellow

### B. Fittings

- 1. Each tank shall be provided with the following fittings. Refer to drawings for locations.
  - a. Fill Line
    - 1) Provide 2" CPVC through dome fill assembly with external fill piping and internal anti-foam elbow. External piping shall be supported without penetrating the tank wall below the maximum storage level.
  - b. Overflow
    - 1) Provide 4" CPVC bolted double-flange overflow fitting.
  - c. Tank Full-Drain
    - 1) Provide an integrally molded 4" flanged drain connection and 4" flexible connection.
  - d. Tank Suction
    - 1) Provide 2" CPVC bolted double-flange tank suction fitting and 2" flexible

connection.

e. Vent

- 1) Provide minimum 6" CPVC "U" vent fitting with CPVC or polypropylene insect screen. Provide larger vent if manufacturer design calculations indicate a larger vent is required.

f. Level Sensor

- 1) Provide 4" CPVC through dome fitting with flange adapter for mounting ultrasonic level sensor.

g. Reverse Float Level Gauge

- 1) Provide appropriate fittings and accessories for a reverse float level gauge on each tank. External piping shall be supported without penetrating the tank wall below the maximum storage level. All materials shall be compatible with chemical being stored.

2. Fitting shall be Schedule 80 CPVC or a material that is compatible with the chemical being stored.
3. Threads on threaded fittings shall be National Pipe Thread (NPT).
4. Fittings shall be installed at the factory prior to application of the insulation.
5. Gasket material shall be EPDM or a material that is compatible with the product being stored and shall be a minimum of ¼-in thick.
6. Bolted flange fittings shall be constructed with 150-lb flanges, 150-lb flange gaskets, and the correct number of all-thread bolts. Flange fittings shall be double flanged and double gasketed.
7. All metal hardware, bolts, nuts, washers, etc. shall be Grade 2, titanium.
8. The head of the bolts shall be encapsulated with polyethylene preventing fluid contact with the metal material. Encapsulated heads shall have a gasket to provide a sealing surface against the inner wall of the tank. Bolt holes shall straddle the principal centerline of the tank.
9. Down pipes and fill pipes shall be supported at maximum 5-ft intervals. Down pipes and fill pipes shall be Schedule 80 CPVC or material compatible with the chemical being stored.
10. U-Vents
  - a. Each tank must be vented for the material and flow and withdrawal rates expected. Vents should comply with OSHA 1910.106(F)(iii)(2)(IV)(9). U-vents shall be sized by the tank manufacturer and be furnished complete with insect screen.
  - b. U-vents shall be constructed of CPVC or material compatible with the chemical stored.

C. Tank Insulation and Heat Tracing

1. Tanks shall be heat traced and insulated.
2. Heating systems shall be designed to meet the specific requirements of the tank such as tank material type, tank size, low ambient temperature, and desired maintenance temperature.
3. Heat tracing shall have a minimum delta-T of 50°F.
4. Heating system components shall be NEMA 4X rated and factory pre-wired for 120 VAC.
5. Provide a control panel to monitor and operate the heat tracing system. The panel shall receive a single 120 volts, AC, 1-phase supply to operate the system as required. Provide all necessary components for a complete and fully functional system.
6. Insulation shall be polyurethane foam with a density of 2.0 - 3.0 lb/ft<sup>3</sup> with an "R" value

of 8.33/in.

7. The foam shall be applied with a nominal thickness of 2" to all external tank surfaces except the tank bottom shell.
8. Insulation shall be coated with a mastic material to protect the insulation from the outside environment.
9. Coating color shall be white.

D. Tank Labels

1. Labels identifying the chemical stored in the tank and the hazard rating.

2.5 FACTORY TESTING

A. Material Testing

1. Perform gel and low temperature impact tests in accordance with ASTM D1998 on condition samples cut from each polyethylene chemical storage tank.
2. Degree of Crosslinking
  - a. Use Method C of ASTM D1998-Section 11.4 to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

B. Tank Testing

1. Dimensions
  - a. Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D1998. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.
2. Visual
  - a. Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, and delamination.
3. Hydrostatic test
  - a. Following fabrication, the vertical, flat bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1/2 an hour and inspecting for leaks. Following successful testing, the vertical tank shall be emptied and cleaned prior to shipment.
4. Prior to shipping tanks, provide engineer with a certified statement from the tank manufacturer that each tank has passed these inspections.

3 EXECUTION

3.1 INSTALLATION

- A. High density cross-linked polyethylene tanks shall be installed in accordance with the Manufacturer's requirements to produce a finished product that is clean and demonstrates true craftsmanship.
- B. Contractor shall install six (6) layers of 30-pound roofing felt paper between the tank and the slab. Felt paper shall be trimmed to the diameter of the tank.
- C. Make all pipe and accessory connections as required. All connections to the tank shall conform to the manufacturer's instructions and the approved shop drawings.
- D. All electrical conduit shall be routed above the top of the containment wall.
- E. Manufacturer shall allow for a minimum of one (1) trip to the project site to assist the contractor with the installation of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.

3.2 STARTUP AND TESTING

- A. High density cross-linked polyethylene tanks shall be field tested after installation to demonstrate proper operation to the satisfaction of the Engineer. Field tests shall be conducted by the Manufacturer or his Authorized Representative. All tests shall be performed in the presence of the Engineer. Test results shall be in printed form and signed by the Manufacturer or his Representative and supplied to the Owner.
- B. Tank(s) shall be tested by filling them with water to the overflow elevation. The tanks and fittings shall hold water without loss, evidence of weeping, or capillary action for a period of 24 hours prior to acceptance. The tank(s) will also be inspected for defects, damage, and conformance with the specifications.
- C. After testing, tank(s) shall be drained, thoroughly cleaned, and dried.
- D. If any leakage, defects, or damage to the tank(s) and fittings is observed during the inspection, testing, or within the warranty period, the Contractor shall repair or replace the defective tank or fittings at no increase in contract price or time.
- E. Manufacturer shall allow for a minimum of one (1) trip to the project site for startup and testing of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.
- F. Manufacturer shall provide services, as required, for the testing and startup requirements specified in Section 01 75 16, Testing and Startup.

### 3.3 CERTIFICATION

- A. A manufacturer's representative that is qualified in the particular equipment requirements shall fully inspect and certify the equipment installation. Written certifications shall be provided that state the equipment is installed properly, is operating within the design parameters, and will be warranted as required by the specifications.

### 3.4 TRAINING

- A. Provide operator training in accordance with Section 01 79 00, Demonstration and Training.

### 3.5 ACCEPTANCE

- A. Acceptance of equipment will not be made until all equipment has been installed and tested, the manufacturer has certified the installation, the manufacturer has conducted the required training classes, final operation and maintenance manuals have been submitted to the engineer, and all spare parts have been turned over to the Owner.

\*\* END OF SECTION \*\*













of the sidewall connected with clear PVC pipe. Nozzles and pipes shall be two inches in diameter.

#### E. Ladder

1. Provide fiberglass access ladder with safety cage and standing platform with handrails for each tank.
2. Standing platform shall be minimum 24" x 24" square and shall be located 48" below the top of the tank. Safety handrails around standing platform shall be supplied.
3. Ladder anchors shall not penetrate the tank wall below the maximum storage elevation.
4. Use proper chemical resistant materials when anchoring to tank dome.
5. Ladders shall be designed to OSHA standard 2206; 1910.27.
6. Ladder design shall be designed to OSHA Standard 2206; 1910.27.
7. Ladders shall be mounted in a manner that will allow for tank expansion and contraction due to temperature and loading changes.
8. Fiberglass material shall be premium grade polyester resin with flame retardant and UV inhibitor additives.
9. Color: yellow

#### F. U-Vents

1. Each tank must be vented for the material and flow and withdrawal rates expected. Vents should comply with OSHA 1910.106(F)(iii)(2)(IV)(9). U-vents shall be sized by the tank manufacturer and be furnished complete with insect screen.
2. U-vents shall be constructed of CPVC or material compatible with the chemical stored.

#### G. Tank Insulation and Heat Tracing

1. Tanks shall be heat traced and insulated.
2. Heating systems shall be designed to meet the specific requirements of the tank such as tank material type, tank size, low ambient temperature, and desired maintenance temperature.
3. Heat tracing shall have a minimum delta-T of 50°F.
4. Heating system components shall be NEMA 4X rated and factory pre-wired for 120 VAC.
5. Provide a control panel to monitor and operate the heat tracing system. The panel shall receive a single 120 volts, AC, 1-phase supply to operate the system as required. Provide all necessary components for a complete and fully functional system.
6. Insulation shall be polyurethane foam with a density of 2.0 - 3.0 lb/ft<sup>3</sup> with an "R" value of 8.33/in.
7. The foam shall be applied with a nominal thickness of 2" to all external tank surfaces except the tank bottom shell.
8. Insulation shall be coated with a mastic material to protect the insulation from the outside environment.
9. Coating color shall be gray.

#### H. Tank Labels

1. Furnish and install all precautionary labeling as recommended by the Occupational Safety and Health Act (OSHA), National Fire Protection Association (NFPA), or Hazardous Material Information System.
2. Labels identifying the chemical stored in the tank and the hazard rating.

### 2.5 FACTORY TESTING

- A. The fiberglass tank manufacturer shall have a quality control procedure in accordance with

ASME RTP-1 to ensure that all fabrication complies with the specified requirements and ensure that all laminates are at least the equal to the reference samples in laminate quality.

- B. Quality control shall include a final inspection by the manufacturer and a written record of this final inspection. Final inspections shall include check for: resin cure, dimensions, laminate thickness, physical properties, reinforcing content, pressure tests and visual inspections for laminate imperfections
  - 1. The resin-rich corrosion barrier, consisting of the inner corrosion barrier (C-glass and veils) and the inner layer (two mat layers), of each tank shall be visually inspected to ensure that the imperfections in this laminate are within the tolerances of Visual Inspection Level 1 as described in Table 6-1 of ASME RTP-1.
  - 2. The structural layer and exterior of each tank shall be visually inspected to ensure that the laminate conforms to the Visual Inspection Level 2 as described in Table 6-1 of ASME RTP-1.
  - 3. All visual inspections shall be made before an exterior pigmented coating, paint or insulation is applied to the shell or head(s) of a vessel.
- C. Inspection records shall be made for each tank. Manufacturer shall send a copy of his inspection records to the Owner for review prior to shipment.
- D. Final acceptance by the Owner is contingent upon satisfactory inspection upon arrival, delivery and installation at the job site.
- E. The manufacturer's inspection records shall provide the following information (in addition to that information specified above):
  - 1. Hardness readings.
  - 2. Thickness measurements.
  - 3. Measurements showing compliance with dimensions and tolerances in diameters, lengths, squareness of ends, angles of fittings and flanges and flatness of flanges.
  - 4. Laminate quality: Presence of pits, foreign inclusions, dry spots, air bubbles, pinholes pimples and delaminations.

### 3 EXECUTION

#### 3.1 INSTALLATION

- A. Fiberglass reinforced plastic tanks shall be installed in accordance with the Manufacturer's requirements to produce a finished product that is clean and demonstrates true craftsmanship.
- B. Contractor shall install six (6) layers of 30-pound roofing felt paper between the tank and the slab. Felt paper shall be trimmed to the diameter of the tank.
- C. Make all pipe and accessory connections as required. All connections to the tank shall conform to the manufacturer's instructions and the approved shop drawings.
- D. All electrical conduit shall be routed above the top of the containment wall.
- E. Manufacturer shall allow for a minimum of one (1) trip to the project site to assist the contractor with the installation of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.

#### 3.2 STARTUP AND TESTING

- A. Fiberglass reinforced plastic tanks shall be field tested after installation to demonstrate proper operation to the satisfaction of the Engineer. Field tests shall be conducted by the Manufacturer or his Authorized Representative. All tests shall be performed in the presence of the Engineer. Test results shall be in printed form and signed by the Manufacturer or his Representative and supplied to the Owner.
- B. Tank(s) shall be tested by filling them with water to the overflow elevation. The tanks and fittings shall hold water without loss, evidence of weeping, or capillary action for a period of

24 hours prior to acceptance. The tank(s) will also be inspected for defects, damage, and conformance with the specifications.

- C. After testing, tank(s) shall be drained, thoroughly cleaned, and dried.
- D. If any leakage, defects, or damage to the tank(s) and fittings is observed during the inspection, testing, or within the warranty period, the Contractor shall repair or replace the defective tank or fittings at no increase in contract price or time.
- E. Manufacturer shall allow for a minimum of one (1) trip to the project site for startup and testing of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.
- F. Manufacturer shall provide services, as required, for the testing and startup requirements specified in Section 01 75 16, Testing and Startup.

### 3.3 CERTIFICATION

- A. A manufacturer's representative that is qualified in the particular equipment requirements shall fully inspect and certify the equipment installation. Written certifications shall be provided that state the equipment is installed properly, is operating within the design parameters, and will be warranted as required by the specifications.

### 3.4 TRAINING

- A. Provide operator training in accordance with Section 01 79 00, Demonstration and Training.

### 3.5 ACCEPTANCE

- A. Acceptance of equipment will not be made until all equipment has been installed and tested, the manufacturer has certified the installation, the manufacturer has conducted the required training classes, final operation and maintenance manuals have been submitted to the engineer, and all spare parts have been turned over to the Owner.

\*\* END OF SECTION \*\*

## SECTION 46 33 44

### HOSE PUMPS

#### 1 GENERAL

##### 1.1 SCOPE OF WORK

- A. The work covered by this section includes furnishing all labor, materials, and equipment required to install, test, and place into satisfactory operation hose pumps and appurtenances as specified herein and as shown on the drawings.

##### 1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these specifications.
  1. Drawings showing plan, elevation, and appropriate cross sections of the equipment being provided.
  2. Complete engineering data including, but not limited to, descriptive data, material specifications, pump performance curves, motor performance data, piping diagrams, and wiring diagrams, as appropriate, to support the design of the equipment being provided.
  3. Submit control panel schematics and layout drawings and submit manufacturer's catalog information for all components used.
  4. Pump performance curves shall, at a minimum, depict the following.
    - a. Head vs. Capacity
    - b. RPM
    - c. Combined weight of pump and motor
    - d. Clearly marked operation points
    - e. Horsepower
    - f. NPSHR
    - g. Kilowatt usage at design conditions
    - h. Efficiency at design conditions
  5. Pulsation dampener and suction accumulator sizing calculations.
  6. Printed warranty

##### 1.3 OPERATION AND MAINTENANCE DATA

- A. The Contractor shall provide operation and maintenance data in accordance with the requirements of Section 01 78 23, Operation and Maintenance Data.

##### 1.4 STORAGE AND PROTECTION

- A. Equipment shall be stored and protected in accordance with the requirements of the manufacturer and Section 01 66 00, Product Storage and Handling Requirements.

##### 1.5 WARRANTIES AND BONDS

- A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Section 01 78 36, Warranties.
- B. The equipment manufacturer shall provide a warranty against defective or deficient equipment, workmanship and materials under normal use, operation and service. The warranty shall be for one (1) year from the date of Engineer's acceptance of the work. The warranty shall be in printed form and apply to all similar units.

2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers include:

- 1. Verderflex
- 2. Watson-Marlow, Inc.

2.2 DESIGN CRITERIA

A. Provide two (2) skid mounted variable speed hose pumps (P-1360A and P-1360B) for pumping ferrous chloride that meets the following design criteria.

<b>Maximum Pump Flow Rate</b>	<b>190 GPH (3.17 GPM)</b>
Operating Pressure	35 PSI
Maximum Rotor Speed	45 RPM
Duty	Continuous
Pumped Media	Ferrous Chloride or Ferric Chloride
Connection Size	1"
Hose Material	EPDM
Insert Material	Polypropylene
Gasket Material	EPDM
Minimum Motor HP	1.5 HP

B. Provide two (2) skid mounted variable speed hose pumps (P-1364A and P-1364B) for pumping sodium hypochlorite that meets the following design criteria.

<b>Maximum Pump Flow Rate</b>	<b>97 GPH (1.62 GPM)</b>
Operating Pressure	35 PSI
Maximum Rotor Speed	45 RPM
Duty	Continuous
Pumped Media	Sodium Hypochlorite
Connection Size	3/4"
Hose Material	Hypalon (CSM)
Insert Material	Polypropylene
Gasket Material	Hypalon (CSM)
Minimum Motor HP	0.5 HP

- C. Provide one (1) skid mounted variable speed hose pumps (P-1362) for pumping sodium hydroxide that meets the following design criteria.

<b>Maximum Pump Flow Rate</b>	<b>95 GPH (1.58 GPM)</b>
Operating Pressure	35 PSI
Maximum Rotor Speed	50 RPM
Duty	Continuous
Pumped Media	Sodium Hydroxide
Pump Flange Size	<sup>3</sup> / <sub>4</sub> "
Hose Material	Hypalon (CSM)
Insert Material	Polypropylene
Gasket Material	Hypalon (CSM)
Minimum Motor HP	0.5 HP

- D. Provide two (2) skid mounted variable speed hose pumps (P-1365A and P-1365B) for pumping sodium bisulfite that meets the following design criteria.

<b>Maximum Pump Flow Rate</b>	<b>30 GPH (0.5 GPM)</b>
Maximum Operating Pressure	35 PSI
Maximum Rotor Speed	40 RPM
Duty	Continuous
Pumped Media	Sodium Bisulfite
Pump Flange Size	<sup>1</sup> / <sub>2</sub> "
Hose Material	Hypalon (CSM)
Insert Material	Polypropylene
Gasket Material	Hypalon (CSM)
Minimum Motor HP	0.5 HP

## 2.3 CONSTRUCTION

### A. Pump

1. Pump shall be positive displacement, peristaltic hose type utilizing a flexible hose and two compressing rotor shoes.
2. Pump motors shall be mounted in the vertical position.
3. Pump rotor shall be mounted directly to the gear reducer output shaft.
4. Pump shall consist of a sealed lubricant filled housing, bolted housing cover, pump hose, rotor assembly, and one-piece connectors.
5. Lubricant shall be a compounded food grade glycerin/propylene glycol blend. Lubrication shall be filled to 40-50 percent of pump housing capacity.
6. Pump shall be completely self-priming with a suction lift capability of up to 30 feet of water.
7. Pump shall be capable of running dry without damaging effects to the pump or hose.

8. Pump housing and housing cover shall be minimum ASTM A48, Class 25 cast iron.
  9. An inspection window shall be provided in the cover to view pump rotation.
  10. The pump housing cover shall contain a lubricant level sight window.
  11. Gear reducer bearings shall be antifriction type, designed in accordance with the AFBMA standards for a minimum B-10 life of 100,000 hours at maximum operating speed and pressure.
  12. Rotor
    - a. Rotor shall be constructed of cast iron and shall be equipped with two sliding shoes.
    - b. Shoes shall be located 180-degrees apart for compression of the hose against the track twice per rotor revolution.
    - c. Shoes shall be adjustable without removing the housing or housing cover.
- B. Hose
1. Hose shall be rated for a minimum operating pressure of 230 PSIG and a minimum burst pressure of 800 PSIG.
  2. Hose shall be in contact with the inside diameter of the housing through an angle of 180 degrees and be held in place on the suction and discharge by a one-piece stainless steel flange assembly.
  3. Hose shall be replaceable without removing the pump or the pump housing cover.
  4. Inlet and outlet flanges shall be ANSI 150 # flanges.
- C. Motor
1. Motor shall be inverter duty rated
  2. Enclosure: totally enclosed non-ventilated (TENV)
  3. Orientation: vertical
  4. Horsepower: see Design Criteria
  5. Voltage Rating: 460 V, 3 phase, 60 Hz with a 1.15 service factor
  6. Speed: 1,800 RPM
  7. Efficiency: premium
  8. VFD Rating: 20:1 constant torque
  9. Insulation: Class H
  10. Each motor shall be equipped with an encoder with a NEMA 4X housing for speed regulation. Vendor shall furnish cable of sufficient length to run between the encoders and the associated control panels.
- D. Gear Reducer
1. Gear reducer shall be of the integral motor/reducer design with helical gears or planetary gears, and rated as AGMA Class II or better for continuous 24 hour, heavy shock duty, with an average efficiency per stage of 95 percent, and a minimum service factor of 1.40, based on motor nameplate rating.
  2. The housing shall be flange mounted to the C-faced motor and be made of gray cast iron.
  3. Bearings shall be anti-friction, of heavy-duty construction and exceed AFBMA standards.
- E. Leak Detection
1. Provide each pump with manufacturer's standard device for detecting leakage of the pumped product into the pump housing.

## 2.4 ACCESSORIES

- A. Provide each pump with the following accessories.
  - 1. Pump skid with a base that lifts pumps a minimum of 12-inch above the floor.
  - 2. Calibration cylinder
  - 3. Suction accumulator with pressure gauge
  - 4. Pulsation dampener with pressure gauge
  - 5. Pressure relief valve
  - 6. Backpressure valve
  - 7. Discharge high pressure switch
  - 8. Pressure gauge
- B. Pump Skid
  - 1. Pump skid shall be manufactured from polypropylene shapes.
  - 2. Maximum skid widths shall be as shown on drawings.
  - 3. Maximum skid depth shall be 36-inches.
- C. Calibration Cylinder
  - 1. Clear PVC with easy to read graduation marks in milliliters and gallons per hour.
  - 2. Size: As specified on drawings.
  - 3. Griffco Valve, Inc. PVC Calibration Cylinder, or equal.
- D. Suction Accumulator
  - 1. Hydro-pneumatic, bladder type suction accumulator to dampen pressure pulsations on suction side of pump.
  - 2. Provide with pressure gauge and charging valve.
  - 3. Size: As specified on drawings.
  - 4. Housing Material: PVC
  - 5. Bladder Material: PTFE
  - 6. Blacoh Fluid Control, Inc., or equal
- E. Pulsation Dampener
  - 1. Hydro-pneumatic, bladder type pulsation dampener sized for a minimum of 95 percent dampening.
  - 2. Provide with pressure gauge and charging valve.
  - 3. Size: As specified on drawings.
  - 4. Housing Material: PVC
  - 5. Bladder Material: PTFE
  - 6. Blacoh Fluid Control, Inc., or equal
- F. Pressure Relief Valve
  - 1. Diaphragm pressure relief valve with 2-port or 3-port socket connections.
  - 2. Size: As specified on drawings.
  - 3. Wetted Part Materials: CPVC
  - 4. Diaphragm Material: PTFE
  - 5. Griffco Valve, Inc. G-Series Pressure Relief Valve, or equal
- G. Back Pressure Valve

1. Diaphragm back pressure valve with 2-port socket connections.
2. Size: As specified on drawings.
3. Wetted Part Materials: CPVC
4. Diaphragm Material: PTFE
5. Griffco Valve, Inc. G-Series Back Pressure Valve, or equal

H. Discharge High Pressure Switch

1. Pressure switch is to be provided by pump supplier.
2. Field adjustable, compact miniature pressure switch.
3. Range: 8-60 PSI
4. Enclosure Material: 316 Stainless Steel
5. Diaphragm Material: 316 Stainless Steel
6. Enclosure Rating: NEMA 6
7. Switch Type: SPDT
8. Electric: 120VAC, 3A
9. End Connection: ¼" MNPT
10. Ashcroft, A-Series Minature Watertight Pressure Switch, or equal

I. Pressure Gauge

1. Pressure gauge shall be liquid filled with 2-inch diameter face and black lettering. Range shall be 0 to 50 psig. Gauge shall be stainless steel and sealed to prevent entrance of moisture. Bourdon tube shall be phosphor bronze with forged brass socket. Connections shall be 1/4-in male NPT. Furnish cartridge type pressure snubbers to reduce gauge pointer pulsations.

J. Diaphragm Isolator

1. Diaphragm isolators shall protect gauges, switches and other instruments from the chemicals being pumped.
2. Wetted and Non-Wetted Part Material: CPVC
3. Diaphragm Material: PTFE

## 2.5 INSTRUMENTATION AND CONTROLS

A. Provide one control panel for each pump provided.

B. Control panels shall contain all of the necessary components for system operation including, but not limited to, the following.

1. Control Panel Enclosure
  - a. Control panel shall be constructed out of fiberglass reinforced plastic (FRP) and shall be rated NEMA 4X.
2. Power
  - a. 480 VAC, three-phase, single point connection
3. Main Disconnect
  - a. Lockable, external disconnect switch that de-energizes the local control panel.
4. Wiring
  - a. AC Circuits
    - 1) 600 volt, Type MTW stranded copper
    - 2) Size: Minimum No. 14 AWG
  - b. Analog Circuits

- 1) 600 volt, Class B, seven strand concentric soft bare annealed twisted shielded pairs meeting requirements of ASTM B8
  - 2) Size: Minimum No. 18 AWG
- c. Separate analog and control wiring from AC wiring by minimum 6-inches.
  - d. Run wiring in plastic ducts or sheet metal raceway.
  - e. Wire Identification
    - 1) Provide wire numbers and tag them at each terminal.
    - 2) Use snap-on or slip-on wire markers with legible machine-printed markings or numbers. Adhesive or taped-on tags are not acceptable and hand written tag numbers are not acceptable.
5. UL listing or recognized
  6. Variable frequency drives for the pumps shall be Yaskawa. VFDs shall accept and use the signal from the pump-mounted encoder for speed regulation.
  7. Safety Interlocks
    - a. Provide safety interlocks to stop the pump or prevent it from starting on alarm conditions, including but not limited to the following:
      - 1) Motor fail
      - 2) High discharge pressure
      - 3) Broken hose
      - 4) All other alarm conditions which would shut down pump operation
    - b. Reset after an alarm condition shall require an operator to press the RESET pushbutton on the front of the panel.
  8. Provide the following front-of-panel devices
    - a. Power On indicator light (white)
    - b. Run indicator light (red)
    - c. Stopped indicator light (green)
    - d. VFD Fault/Overload indicator light (amber)
    - e. Broken Hose indicator light (amber)
    - f. High Discharge Pressure Shutdown indicator light (amber)
    - g. LOCAL/REMOTE selector switch
    - h. START/STOP selector switch
    - i. RESET pushbutton
    - j. VFD manufacturer's HIM
    - k. Non-resettable run-time meter (if not integral to the HIM)
  9. Panel shall accept the following signals for remote control of the pump
    - a. START/STOP from remote dry contacts
    - b. Speed control from remote 4-20 mA signal
  10. Panel shall have the following dry contacts for remote indication. Dry contacts for alarm conditions shall be normally-closed and shall open when the associated alarm condition has occurred.
    - a. Run Status
    - b. Common Fault to include any of the alarm conditions including VFD Fault/Overload/Broken Hose/High Discharge Pressure Alarm

- c. In Remote
  - d. Broken Hose
  - e. High Discharge Pressure
11. Panel shall have the following 4-20 mA analog signals for remote indication.
- a. Speed feedback
12. Nameplates
- a. Provide nameplates for all items on the control panel.
  - b. Provide panel nameplate that has the following information
    - 1) Pump number
    - 2) Chemical pumped
    - 3) Panel number shown on the P&IDs
13. Control Power Transformer
- a. Provide a control power transformer for control voltage as required.
14. Surge Suppression Unit
- a. Provide a surge suppressor in the control panel to protect against lightning and other surges. Connect surge suppressor to the incoming feeder terminals.
15. Selector Switches and Indicator Lights
- a. Control operators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be Cutler-Hammer/Westinghouse Type E34, Square D Company Type SK, or equal. Control operators shall be 30.5 mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant.
  - b. Pushbuttons shall be non-illuminated, spring release type. Pushbuttons shall include a full guard. Panic stop/alarm pushbuttons shall be red mushroom type with manual-pull release. Selector switches shall be non-illuminated, maintained contact type. Pilot lights shall be of the proper control voltage, push-to-test LED type with light lens colors as specified herein.
  - c. Control operators shall have legend plates as specified herein, indicated on the Drawings, or otherwise directed by the Engineer. Legend plates shall be plastic, black field (background) with white lettering. Engraved nameplates shall be securely fastened above each control operator. If adequate space is not available, the nameplate shall be mounted below the operator.
  - d. Control operators for all equipment shall be as specified herein and of the same type and manufacturer unless otherwise specified or indicated on the Drawings.
16. Operation
- a. When the local operation has been selected from the front-mounted Local/Remote selector switch, the pump shall be operated from the panel's start/stop selector and speed shall be controlled through VFD's HIM unit
  - b. When remote operation has been selected from the front-mounted Local/Remote selector switch, the pump shall be started and stopped by remote dry contacts and speed shall be controlled by the remote 4-20 mA analog signal.
  - c. Pump shall be stopped by the following alarm conditions in both local and remote modes. When the alarm condition occurs, stop the pump, illuminate energize the associated alarm light, and change the state of the alarm contacts to indicate the alarm condition. Provide time delays for activating alarms as indicated below:
    - 1) High discharge pressure. To accommodate pressure pulsations, provide 0-60 second time delay initially set at 15 seconds prior to stopping the pump and indicating the alarm condition.

2) VFD Fault/Overload/Broken Hose

- d. After an alarm condition occurs, alarm indicating lights shall remain lit and alarm contacts shall remain latched in the alarm state until the RESET pushbutton on the front of the panel is pressed

2.6 SPARE PARTS

- A. Provide the following spare parts.
  1. Provide two (2) spare hoses per pump.
  2. Provide lubricant for two hose changes per pump.
  3. Provide one (1) set of all special tools (including tool box) required for working on the pumps. Tool box shall be painted metal with cylinder lock and duplicate keys.
- B. Spare parts shall be boxed and clearly labeled as to what equipment it is provided for.
- C. Spare parts shall be of the same type and quality as the parts provided in the original equipment package.

3 EXECUTION

3.1 INSTALLATION

- A. Pump(s) shall be installed in accordance with the Manufacturers requirements to produce a finished product that is clean and demonstrates true craftsmanship.
- B. Manufacturer shall allow for a minimum of one (1) trip to the project site to assist the contractor with the installation of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.

3.2 STARTUP AND TESTING

- A. Pump(s) shall be field tested after installation to demonstrate operation without excessive noise, vibration, or over heating to the satisfaction of the Engineer. Field tests shall be conducted by the Manufacturer or his Authorized Representative. Field test shall include, but not be limited to, checking for correct rotation, correct operation at design point(s), maximum motor amperage draws within the nameplate specifications, and balanced voltages on each power leg with the pump operating to within Manufacturers tolerances. All tests shall be performed in the presence of the Engineer. Test results shall be in printed form and signed by the Manufacturer or his Representative and supplied to the Owner.
- B. Manufacturer shall allow for a minimum of one (1) trip to the project site for startup and testing of the equipment. If additional trips are required, they shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.
- C. Manufacturer shall provide services, as required, for the testing and startup requirements specified in Section 01 75 16, Testing and Startup.

3.3 CERTIFICATION

- A. A manufacturer's representative that is qualified in the particular equipment requirements shall fully inspect and certify the equipment installation. Written certifications shall be provided that state the equipment is installed properly, is operating within the design parameters, and will be warranted as required by the specifications.

3.4 TRAINING

- A. Provide operator training in accordance with Section 01 79 00, Demonstration and Training.

3.5 ACCEPTANCE

- A. Acceptance of equipment will not be made until all equipment has been installed and tested, the manufacturer has certified the installation, the manufacturer has conducted the required training classes, final operation and maintenance manuals have been submitted to the engineer, and all spare parts have been turned over to the Owner.

\*\* END OF SECTION \*\*